THE BOOK OF KNOWLEDGE

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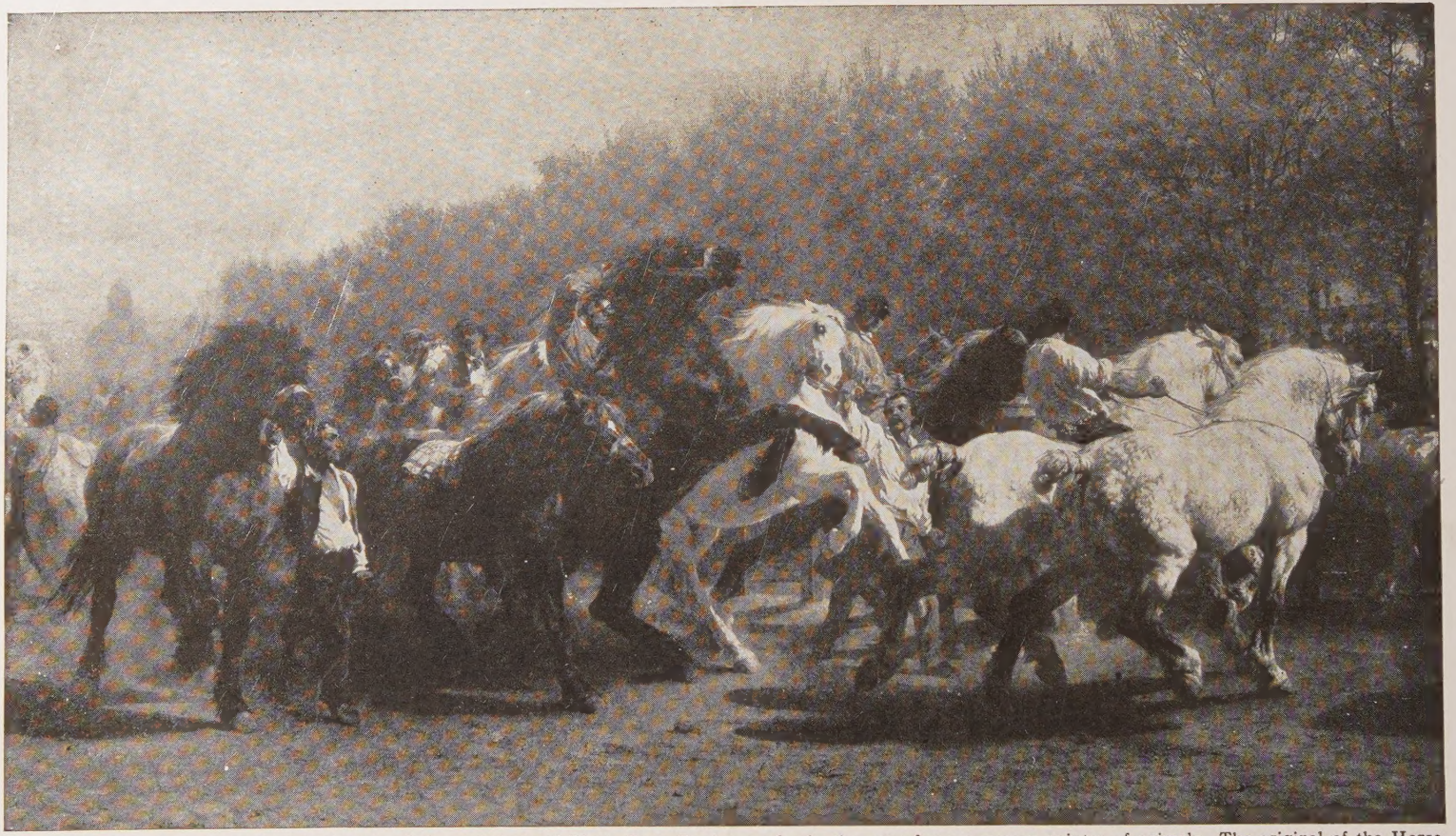
THE HORSE FAIR



The Horse Fair is perhaps the best known of the paintings of Marie Rosa Bonheur, who is the most famous woman painter of animals. The original of the Horse Fair is exhibited in the Metropolitan Museum, in New York City, but a smaller replica of this beautiful work is in the National Art Gallery in London. Her studio and home near the Forest of Fontainebleu is world-famous and during the Franco-Prussian war was respected by order of the Crown Prince of Prussia.

The Book of Knowledge

The Children's Encyclopædia

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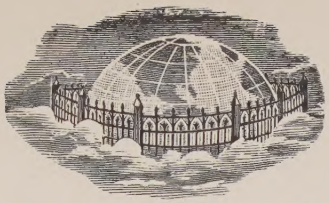


CONTENTS OF THIS VOLUME

This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, colour pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases are given the pages where these parts of our book begin. The full list of these things comes into the big index to the whole work.

PAGE

THE BOOK OF THE EARTH
- How Heat Travels 4319
- How Heat Works for Us . . . 4365
- Heat and Temperature 4473

THE BOOK OF THE UNITED STATES
- Perry's Victory on Lake Erie . . 4279
- The Trial of the Spy 4281
- A Visit to New York 4305
- Thomas Alva Edison 4447
- The Days We Celebrate . . . 4463

THE BOOK OF FAMILIAR THINGS
- The Life of a Sponge 4236
- England's Eyes and Arms . . . 4425
- The China on the Table . . . 4477

THE BOOK OF WONDER
- Why Does an Iceberg Float? . . 4229
- Why Is Sugar Sweet? 4230
- What Is at the End of Space? . . 4232
- Where Does Smoke Go? . . . 4337
- What Makes Cream Form on Milk? 4340
- Could the Sky Fall Down? . . . 4437
- What Set the Sun on Fire? . . . 4437
- What Makes our Teeth Chatter? . 4439
- How Do Snakes Move Along? . . 4443

See index for full list of questions

THE BOOK OF NATURE
- Plants of Two Worlds 4285
- Little Known British Flowers . . 4417
- American Shrubs 4487

THE BOOK OF MEN AND WOMEN
- The Makers of Telegraphs and Telephones 4313
- Nelson, Wellington, Napoleon . . 4355

THE BOOK OF OUR OWN LIFE
- The Story of the Eye 4213
- The Parts of the Eye 4293
- The Light in Our Eyes 4401
- Seeing Colors 4507

THE BOOK OF CANADA
- Hopewell Rocks 4240
- Some Well Known Canadians . . 4299
- The Library of Parliament . . . 4303

PAGE

THE BOOK OF GOLDEN DEEDS
- The Brave Apprentice 4333
- The Woman Who Clothed the Poor . 4334
- The Man Who Died Translating the Bible 4336
- The Little Girl Trusted with State Secrets 4336
- The Friend of the Slaves . . . 4445
- A Woman Who Saved Her Family . 4446

THE STORY OF FAMOUS BOOKS
- The Count of Monte Cristo . 4325, 4407

THE BOOK OF STORIES
- The Three Little Pigs 4219
- The Dog that Remembered Odysseus . 4221
- The Story That Had No End . . 4222
- The King of the Golden Mountain . 4225
- Napoleon's Wonderful Escape . . 4227
- The Prince's Five Servants . . 4271
- How the Bad News Reached the King 4273
- The Fables of Æsop, the Slave . . 4274
- A Pair of Old Boots 4275
- Fools and Jesters and Kings . . 4278
- The Water of Life 4373
- Merrymind, the Little Fiddler . . 4375
- How the Mail Coach Began . . 4380
- The Elfin Hill 4513
- The Story of the Months . . . 4515
- The Timid Hare 4522
- A Brave Little Quakeress . . . 4531
- Pocahontas 4533

STORIES IN FRENCH
- Æsop's Fables in French . . . 4278

FABLES OF THE BUDDHA
- The Strongest Thing 4223
- The Wise and Foolish Fairies . . 4223
- The Crane and the Wise Crab . . 4224

LEGENDS OF TOWN AND COUNTRY
- The Man in the Moon 4277
- St. Keyne's Well 4277
- The Chest of Caller Pit 4277
- The Biddenden Maids 4277

THE BOOK OF POETRY
- The Raven 4263
- The Housekeeper 4264

PAGE

Ahab Mohammed 4265
Speak Gently 4265
A Life Lesson 4265
The Work of the Poets . . . 4266
The Gladness of Nature . . . 4266
A Poet's Last Thoughts . . . 4266
The Sandpiper 4266
Kilmeny: A Fairy Legend . . . 4393
Opportunity 4396
The Discoverer 4396
The Flight of the Arrow . . . 4396
The Lord's Prayer in Verse . . . 4396
Jesus, Lover of My Soul . . . 4397
A Stanza on Freedom 4397
The Good, Great Man 4397
Lord, It Belongs Not to My Care . 4397
The Spanish Armada 4523
The Hunting Song 4524
To a Mountain Daisy 4524
At Sea 4524
His Mother's Joy 4525
The Men of Old 4525
The Lost Doll 4525
A Nation's Strength 4525
The Stormy Petrel 4526
Sorrow 4526
Great Nature Is an Army Gay . . 4526
November in England 4526
Battle-Hymn of the Republic . . 4527
Song of Birds 4527
The Princess 4527
The Ugly Princess 4527
Little Verses . . . 4267, 4398, 4528

THE BOOK OF ALL COUNTRIES

Africa Outside the British Empire . 4251
Mexico and Central America . . 4381
The History of South America . . 4497

THINGS TO MAKE AND TO DO

How to be Your Own Magician

The Way to Identify a Selected Card . 4248
Tricks with English Pennies . . 4455
Blowing a Brick Over on a Table . 4457
Tying Two People Together . . 4462

PAGE

The Little Vegetable Garden

What To Do at the End of September 4353
What To Do at the End of October . 4462

Miscellaneous

Games for a Children's Garden Party . 4242
Using a Brownie Camera . . . 4243
A Little Toy Cannon 4245
Making a Collection of Rocks . . 4246
How to Make a Dainty Blotter . . 4247
A Children's Encyclopædia Party . 4248
The Right Way to Mend Things . . 4249
An Easily Made Stencil Plate . . 4250
The Game of Lawn Tennis . . . 4347
Easy and Useful Rustic Carpentry . 4349
What To Do with Spools and Bricks . 4352
How To Make Our Own Toilet Tidy . 4353
Making a Chemical Weather Glass . 4354
The English Game Croquet . . . 4451
A Salt Water Aquarium . . . 4454
The Right Way To Clean Things . 4456
Dolls Made from Clothes-pins . . 4457
Keeping Guinea-pigs as Pets . . 4458
A Doyley Made of Hairpin Work . 4459
How To Play Draughts, or Checkers 4460
Music from Drinking Glasses . . 4461

Little Problems

How Did the Farmer Enlarge the Fold? 4248, 4354
The Puzzle of the Trees in the Park . 4250
The Problem of the Traveller's Dinner 4250
Who Are These People? . 4350, 4458
Some Puzzle Rhymes and Verses 4351, 4458

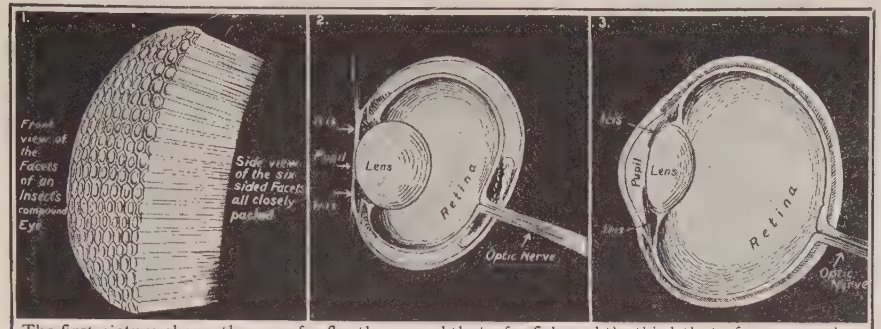
THE BOOK OF SCHOOL LESSONS

French

Picture Lessons . . 4241, 4304, 4535

COLORED PLATE

Wellington's First Meeting with the French 4355



The first picture shows the eye of a fly, the second that of a fish, and the third that of a man, and we can see, by comparing these, how much nearer the fish's eye is to a man's than is that of an insect.

THE STORY OF THE EYE

CONTINUED FROM 4078

THE sense which we are now going to study is vision, or seeing, and the organ of this great sense, as everyone knows, is the eye. In many ways, this is the most wonderful and important of the senses. It is so for the purposes of practical living. It is more necessary to see than to hear, or taste, or smell. A blind man is at a greater disadvantage than a deaf man. The progress and ascent of living creatures on the earth have very largely depended upon vision, and we have already learnt that the vision part of the brain is largest in the highest forms of life. It is much larger in ourselves than in any other creature.

Vision is also of the highest importance for our ideas of the world in which we live, just as it is for our practical doings in that world. If we could not see we should know very much less of our own earth, and we should know the sun only by the radiant heat that he sends us; and all the other heavenly bodies would be unknown to us—from our own little moon to the millions of stars. It is upon our eyes, then, that our knowledge of the great world beyond our own earth depends, and on this claim alone our eyes are entitled to special respect. Unlike any of our other senses, they put us directly in touch with the infinite and the sublime. One of the greatest men who ever lived, Emmanuel Kant, said that there were two things which filled him with awe—the feeling of duty inside the minds of men and the starry heavens above us. Let us begin, then, by studying how, in the course of long ages, living creatures have been able to develop the eyes by which the starry heavens are seen.

This question of the history of the eye is deeply interesting. A short time ago we should have begun straight away with the history of the eye in the animal world. It would not have occurred to anyone that there was anything to say about eyes or seeing in the world of plants, but it has just been discovered that seeing of a kind, at any rate, is not confined to the animal world. There are older eyes than any backboned animal, at any rate, can boast of, and we find them among plants. If we are really to understand our own eyes, therefore, we must begin at the beginning, with something much older and simpler than our eyes or any part of us.

The eyes of plants are very simple. The business of a green plant, and especially of the leaf of such a plant, is to receive and use the light that falls upon it. It is therefore in the leaves of plants that we find their eyes. Simple experiments—which have now been made many times

over, with many kinds of plants—show, to begin with, that somehow or other the leaf is sensitive to light.

For instance, if the direction of the light is altered, in a very short time the leaf turns itself, so as to get the light fair and square upon its surface; and some leaves will do this as often as the direction of the light is changed. We may, perhaps, get rather wrong ideas if we say that the leaf sees the light, yet that must be what happens; only it is a very simple kind of seeing. It is, perhaps, rather like the very first kind of seeing that is done by a new-born baby.

THE LITTLE EYES BY WHICH A LEAF CAN SEE

After it had been completely proved that somehow or other the leaves can see, the next thing, of course, was to find whether the leaf saw as a whole, or whether it had any special places where it saw—places which must be called eyes of a kind. When the surfaces of leaves were carefully examined, it was often found that there were places where there was developed a kind of simple eye. That is to say, certain of the cells forming the surface of the leaf were made of a special shape; it was found that the outside of these cells is curved, just as the front of our eyes is curved.

The consequence is that light falling upon these cells is focussed, as we say, and thrown upon the floor of the cell, just as a curved piece of glass will focus the sun's rays and throw a bright spot on a piece of paper. If the leaf is at right angles to the light, then the bright spot made in this way will fall right on the middle of the floor of the cell.

WHAT HAPPENS WHEN A LEAF DOES NOT LOOK STRAIGHT AT THE LIGHT

This corresponds to what happens in our eyes when we are looking straight at a thing, and the picture of that thing falls, as we shall soon learn, upon exactly the right place at the back of our eyes—the place where we see best. But when the leaf is not facing the light—not looking straight at it, as we might say—the little bright circle that should fall upon the middle of the floor of the cells is thrown somewhere to one side of the floor, or may even be thrown not upon the floor of the cell at all, but upon one of its walls; and the life of the cell knows the difference.

Of course, these discoveries have excited the greatest interest among those people who care for these things, and at first, as was quite right, many doubts were expressed, but these have all been cleared away. In the first place, it was necessary to prove that the curving of the surface of the cells really made them act like little lenses.

In two ways this can be proved; either the surface of the leaf can be, so to speak, shaved down, so that it becomes flat, or else a little water can be laid on the leaf and then covered with a thin sheet of glass, in such a way that the water fills up the hollows between the cells, and so makes the leaf flat, whereas before it was covered with hundreds of little bulging eyes.

When these experiments were made, it was found that the plant no longer responded to the light; the leaf no longer turned so as to face the light directly—in a word, it no longer knew where the light came from. Its sight had been spoilt, just as our sight would be spoilt if something of the kind were done to our eyes.

PHOTOGRAPHS THAT CAN BE TAKEN WITH THE EYES OF A LEAF

And then, still more lately, the power of these little eyes was proved in another way. If these cells with their curved fronts really act as lenses, then, with care and skill, it ought to be possible to make them take photographs—that is to say, it ought to be possible to use these little cells as the lenses of a hundred tiny little cameras. This has been done, and the most excellent photographs have been taken—photographs so good that the person photographed can quite easily be recognised when the photograph is magnified and thrown on a screen.

This subject is quite new, and we are only at the beginning of our knowledge of it. A beginning has been made, however, with a new chapter in our knowledge of plants and their wonderful lives. Here, it is sufficient just for us to know that plants, which live by the light of the sun, and upon whose life our own lives depend, have little eyes of their own, which they use for their lives, and therefore, in the long run, for ours. It is because all animal life depends upon plants that we should know these things. And now we can go on to study the history of the eye in the animal world.

In the very lowest forms of animal life we find that there is response to light, for we find that some of the simplest kinds of animal will always travel from shadow into the light, and others will always travel from light into shadow. These are creatures whose bodies are so simple that we should not look for any special organ of vision.

How the first trace of an eye is found in the skin

Probably the first trace we have of such an organ—that is to say, the first trace of an eye—is where we find that, in certain lowly animals, parts of the skin are very sensitive to light. We find in such cases that the colour of the animal changes according to whether it is in light or in darkness or in shadow, and when its skin is examined under the microscope, we find that it contains a large number of cells packed with coloured material.

This is usually called pigment, which is simply the Latin for paint—in fact, another form of the word paint. These pigment-cells are sensitive to light. When light shines on them, all the pigment is gathered tightly up into the body of the cell; but when the light is taken away, and they are in shadow, the pigment strays out in all directions from the centre of the cell, and so is scattered.

This explains why the colour of the animal changes, and it also tells us why and how the animal is able to know what the state of the light is, and to act as it pleases accordingly. In the study of the history of the eye, great stress has always been laid upon these pigment-cells; but now that we have discovered such wonderful eyes in leaves, fitted with lenses so perfect that they will take photographs, the pigment-cell, which we look upon as the beginning of the animal eye, seems to be a very poor affair compared with a plant eye.

The little cells in the skin upon which light acts

We do not know exactly how it is that light affects the pigment-cells, but we may be sure that the action is really a chemical one. Everyone who is interested at all in photography knows that light has a chemical action—as, for instance, on the salts spread on a photographic plate. Every housewife whose curtains fade, or who puts clothes out to be bleached, knows also that light has a chemical action. Its action on the pigment-cells is chemical also; and when we come to study what happens in our own eyes when the light strikes the curtain at the back of them, we shall find that what happens there is very like the action of light when it takes the colour out of a curtain or a dress.

What happens next in the history of the eye is that the pigment-cells, which were at first scattered about the surface of the body, get to be specially collected in certain places. These cells are not quite on the surface of the skin, but are underneath the outer skin, and the next stage is that, at the place where the pigment-cells are gathered together, the outer skin, or epidermis, becomes thickened, and bulges a little. Now, this is very important, because if we have a bulging, that is to say, a curved surface, through which the light must pass on its way to the pigment-cells, we have indeed a lens of the shape called *convex*, and, as we know in the case of the burning-glass or the lenses of leaves, the result is that the light is focussed.

The simplest kind of eye, and the wonderful eye of a fly

Now, we have already learnt enough to be sure that these pigment-cells, like every other part of the body, are connected by nerves with the brain. So now we have reached the stage where there is a lens to focus the light, sensitive cells to be chemically affected when the light falls upon them, and nerves that somehow convey a record of these changes to the brain, which therefore sees. Here, then, is a simple kind of eye, complete from the surface to the centre.

All the eyes of animals that have no backbone are to be looked upon as simply improved patterns of this kind. The eye in such creatures is always developed from the skin in the case of each individual, just as we have learnt that, in the history of these animal forms, the eye has gradually become developed from the skin. We shall soon see that the eyes of backboned animals are of a much higher type; but we must not underrate all the eyes below backboned animals, because it is very certain that the eyes of some insects are exceedingly keen. It is generally agreed that the dragon-fly is the most wonderful insect of all in this respect. Its eyes are extremely large and powerful.

As in many other cases, the lens of the eye, instead of being just curved in one single simple bulge, so to speak, is like a large diamond that has had its face cut into a number of little flat surfaces. These little faces of the lens are usually called *facets*. The number of facets upon the lens of the eye of the dragon-fly has been counted to be as high as 17,000!

How the Dragon-fly Amuses Itself by Making Fun of Men

Few things are more wonderful than the certainty and skill with which the dragon-fly will recognise, follow, and catch the smallest insect on the wing. One of the greatest living students of this subject, Professor Forel, one of the many wise men who have made Switzerland famous, writes as follows: "By trying to catch them at the edge of a large pond, one can easily convince oneself that dragon-flies amuse themselves by making sport of the hunter; they will always allow one to approach just near enough to miss catching them.

"It can be seen to what degree they are able to measure the distance and reach of their enemy. It is an absolute fact that dragon-flies—unless it is cold or in the evening—always manage to fly at just that distance at which the student cannot touch them; and they see perfectly well whether one is armed with a net or has nothing but his hands. One might even say that they measure the length of the handle of the net, for the possession of a long handle is no advantage. They fly just out of reach of one's instrument, whatever trouble one may give oneself by hiding it from them and suddenly lunging as they fly off."

We must not suppose that all insects have good eyes; there are all stages between the dragon-fly, at one extreme, and insects which are completely blind, as, for instance, the cave-dwelling insects and certain kinds of worker-ants which live entirely underground.

The House-fly that has Learnt to Keep Away from the Gas-flame

The rule for most insects is that they fly towards the light. Artificial lights, such as we use, do not occur in Nature, and an insect flying towards a lamp really supposes that it is flying towards the light of day. It is most unfortunate, from our point of view, that a good many domestic insects have learnt in the course of many years to know what artificial light is. We cannot now enter into the very difficult question how it is that this change has been brought about in their natural habits; but, at any rate, it is the case that such an insect as the ordinary fly—as we know it now—does not destroy itself by flying against a flame, and so is able to live freely in our houses.

The habits of flies are extremely dirty; their feet are always laden with filth. They are thus great carriers of disease, and destroy many babies every year by poisoning their food. That is why it is very unfortunate that flies have learnt how to behave to artificial light in what, for their ancestors, would have been an unnatural way.

Many years ago Lord Avebury showed that bees and wasps were able to distinguish colours; but wasps are very inferior to bees in this respect. Bees distinguish all colours, and very rarely make any mistake except between blue and green. The importance of this is very great, because it largely helps to explain how it is that bees are able to distinguish one flower from another.

Insects that can See what our Eyes cannot See

As a rule, the colour of a flower is a kind of flag held out to say to a bee or other insect: "Come here; I have something that you will like." So the bee gets its honey and the flower gets fertilised. Thus we owe the pleasure our eyes get from most of the beautiful flowers we know to the fact that the eyes of bees and other insects are able to see them and to distinguish them. If there were no insects there would be no beautiful flowers; there would be nothing for the plant to hang out its flag for.

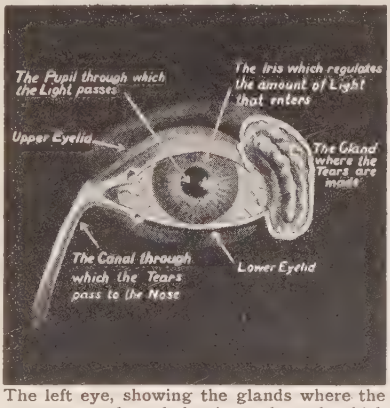
It was also proved by Lord Avebury, nearly thirty years ago, that ants, for instance, can see kinds of light to which our eyes are blind—that is to say, the light which lies beyond the violet, and which is known as *ultra-violet* light.

Here we may notice, what has recently been shown, that people's eyes vary in this respect. Just as old people do not hear high-pitched sounds, which younger people can hear, so we find that there are a good many young people who, rather like ants, can see a little way, so to speak, into the ultra-violet, where, to the rest of us, it is quite dark. Finally, Lord Avebury has shown

that ants are able to recognise each other after more than a year of separation. Let us beware of judging the value and power of things by their size, and let us learn from this brief account of one of the senses of insects that we still have reason to go to the ant to "consider her ways and be wise."

Now we must pass to the eyes of backboned animals. The lowest kinds of backboned animals are the fishes, and we have all seen the eyes of fishes. Wonderful and skilful as the eyes of insects may be, the eyes of backboned animals are of a vastly finer and more wonderful type. In the first place, this seems to depend upon a change in the making of the eye. We have seen that the eyes of all the animals that have not backbones are entirely formed from the skin; but the higher type of eye found in backboned animals has its most important parts developed from the brain, and not from the skin at all.

True, the front part of such eyes as our own is formed from the skin, but that is only true of the parts through which the light travels on its way to the all-important curtain which makes the back of the eye. That curtain is really a part of the brain which has been pushed out, as it were, from the brain upon a kind of stalk or stem.


The Pupil through which the Light passes
The Iris which regulates the amount of Light that enters
Upper Eyelid
The Gland where the Tears are made
The Canal through which the Tears pass to the Nose
Lower Eyelid

The left eye, showing the glands where the tears are made and the ducts through which they are carried to the nose after washing the eyeball. In weeping, the tears cannot all pass through the ducts, and so they overflow

The real reason why the curtain, or retina, of the eye of backboned animals has its great powers—vastly superior to those of any lower type of eye—is that this retina is, indeed, a part of the brain itself. Vision is so important that the brain, so to speak, could not leave the business of receiving the light-rays to anything developed from the skin, but decided to send out a portion of itself, so that the work should be done as well as possible.

In main principles, the eye of backboned animals is much the same, no matter which particular animal we take. The eye of the fish is certainly very much inferior to that of a bird or a mammal, as we should expect, if we consider that the fish has to see only in water, where it would be impossible for any kind of eye to see more than very short distances; but even the eye of the fish is, in all the main points, the same as our own, though much simpler.

We need not discuss specially the eyes of birds, though everyone knows that they have some powers superior to those of the eyes of any other creature. These powers are in the direction of keenness, so that we say of anyone who is very sharp to see things that he has the eyes of a hawk. This keenness is at its best in the case of the hawk and other birds of prey, but other birds also have very keen eyes. They could not catch flying insects if they had not. In praising the eye and the keenness of vision in birds, and in studying their eyes, we must not make the mistake, which is commonly made by almost everyone who has studied this subject and written upon it, of supposing that mere keenness of vision is everything.

It is easy to see what a mistake that is, if we consider the case of a sailor, for instance, who has very keen eyes indeed, and can see far into a fog, but who would perhaps never cast a second glance upon the most noble picture that was ever painted, or upon the most lovely landscape. On the other hand, a great artist may be old and very nearly blind, and though his vision is very dim, yet he can see in a sunset or in a picture things which mere keenness of vision, whether in a man or a hawk, could never see at all. This is worth remembering, for it is just as true of all the other senses as it is of vision.

Keenness of sense is very good in its way, and well worth having, but it is one thing to have sharp eyes or sharp ears, and another to have eyes or ears, perhaps not at all sharp, which can see and appreciate the really beautiful and lovely. If we remember this, we shall be very far from agreeing with those who

say that the eyes of birds of prey or of the dragon-fly or of the tiger, or of certain of the lower races of men, are better and finer eyes than our own; they are nothing of the kind.

We are entitled to say they are not because we know that keenness is not the highest quality of a sense, and the best proof of the rightness of our view is to be found in the fact that, when we test the matter by the brain, we find that the vision area is largest and most highly developed, not in the insect or the bird, or in the men with the keenest eyes, but in the brains of the highest type of men, who have learnt to see and love what is beautiful and poetic.

THE EYELID THAT WASHES THE EYEBALL AND KEEPS IT MOIST

And now we are prepared to look at our own eyes and see how they are made. It is right just to mention the eyelids, because they exist for the sake of the eyes, and the eye cannot get on without them. We are very wrong if we suppose that the eyelids merely exist in order to cut off the light when we do not wish to see. They have that purpose, but if we had to do without them, and replace them by an artificial shade, we should soon find that that is not the whole of their use, but that they have another use that is of the greatest service to the eyes.

Every time that we wink—which we do every few seconds without thinking about it—the upper eyelid washes the front of the eyeball by means of a tear which has come from the tear-gland, and has been spread over the inside of the upper eyelid.

The tear-gland lies above the eyeball, a little to its outer side. The tear, after washing and moistening the front of the eyeball, passes through a tiny hole at the inner end of the lower eyelid into the nose, as may be seen in the picture of the eye on page 4217.

WHY WE CRY WHEN WE ARE IN SORROW OR DISTRESS

The reason why we cry when we are distressed seems at first to be that the part of the brain connected with the tear-glands lies very close to the part of the brain which is disturbed when we are made unhappy. It has been pointed out that if the arrangement of the brain were slightly different from what it really is, instead of producing an extra quantity of tears when we were miserable or unhappy, we might produce an extra quantity of saliva.

This very unpoetic suggestion was made by a poet. It has been credited by several students of the subject. The present writer believes, however, that the truth is very much more poetical than that poet suggested. The real reason, we may believe, why we show signs of distress in our eyes rather than anywhere else is that we human beings live by one another's help and sympathy and love. We are meant to see when others are unhappy, so that we may know, beyond any doubt, when they are needing our sympathy and help.

If a child's mouth merely watered when it was unhappy, we should not know, and therefore would not help it; but when we see its eyes water our sympathy is aroused, and we help it. We cry, not because the brain happens to be so made, but the brain has been so made because crying is the most useful and convenient way in which our distress can be shown to others.

HOW THE FACE AND THE EYE EXPRESS OUR FEELINGS

As the higher parts of the brain develop we learn self-control, and cry very much less readily than when we are quite young; but it is still true that our feelings find expression that can be seen by other people, for the face shows our feelings, and when we make a general study of the way in which our feelings are expressed by the various parts of the face, we shall see that crying fits in with these other ways of expression as the watering of the mouth would not, so that it is more than a mere chance that sorrow and sadness find expression in the shedding of tears rather than in the production of saliva or in some other way.

The eyelids are provided with hairs which help to protect the eyes from dust. Besides the protection afforded by the eyelashes, the eyebrows are to be reckoned with, as they prevent the sweat of the forehead from running into the eye. Lastly, we have to notice the well-contrived bony structure of the skull around the eye, which furnishes a very wonderful protection.

The next part of this begins on page 4293.

THE THREE LITTLE PIGS

CONTINUED FROM 4130

ONCE upon a time, three little pigs went out into the world to seek their fortunes. The first little pig had not gone far before he met a man who was carrying a bundle of straw.

"If you please," said the little pig, "will you give me some of that straw to make me a house?"

"With pleasure," replied the man.

Away went the little pig with the straw, and built his house.

Now, an artful old wolf who lived close by determined to have the little pig for supper. So when it became dusk he went up to the little straw house and called out:

"Little pig, little pig, may I come in?"

But the little pig knew his voice, and said:

"No, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the little pig, and gobbled him all up.

The second little pig met a man carrying some sticks.

"If you please," said the little pig, "will you give me some of those sticks to make me a house?"

"With pleasure," replied the man.

Away went the little pig with the sticks, and built himself a cosy house.

That night the wolf came to the door.

"Little pig, little pig," cried the wolf, "may I come in?"

"No, no," replied this little pig, as the other one had done; "by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf in a rage. "Then I'll puff and I'll blow till I blow your house in."

And he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the poor little pig, and gobbled him all up.

But the third little pig was exceedingly wide awake the morning *he* set out on his travels. This little pig went on till he saw a man carrying bricks.

"If you please," said the little pig, "will you give me some of those bricks to make me a house?"

"With pleasure," replied the man.

Away went the little pig with the bricks, and built his house.

Soon the old wolf came along that way, and knocked at the door.

"Little pig, little pig, may I come in?" cried he.

"No, no; by the hair on my chinny, chin, chin!"

"Then I'll puff and I'll blow till I blow your house in!"

But the house was made of bricks, and the old wolf he puffed and he blew, and he puffed and he blew,

THE WOLF CAME BACK AGAIN TO THE HOUSE

"Dear me, how late you are!" said the little pig when he saw the wolf. "I've been back an hour or more. I'm sure I'm much obliged to you, they were fine turnips!" The wolf was furious, but pretended he did not mind.

and still the house stood firm. At last he went away in a rage; but presently he came back again.

"Little pig, little pig, I know a field just down the lane where there are such fine turnips. I'll call for you in the morning and show you the way."

The next morning when the wolf called out: "Are you ready, little pig?" the little pig replied: "Dear me, how late you are! I've been back an hour or more. I'm sure I'm much obliged to you; they were fine turnips!"

The wolf was furious; but, pretending he did not mind, he said, quite pleasantly:

"Do you like apples? I know an orchard down the lane where the trees are covered with fruit. I'll call for you in the morning, and show you the way."

The next morning the wolf got up very early, and walked round to the little pig's house. But the little pig must have got up earlier still, for when the wolf arrived he found him out.

The wolf hurried off to the orchard; but the little pig saw him coming, and climbed up into a tree.

"These are indeed fine apples," he called out, as the wolf came up to it. "Just try this one." And he threw the apple as far away as he could into some long grass. Then, while the wolf was hunting for it, the little pig scrambled down the tree, and ran home.

The wolf did not like being beaten, so the next morning he went again to the little pig's house, and said:

"Little pig, little pig, there's going to be a fair on the village green this afternoon. You come along with me, and we'll both have a fine time. I'll call for you at exactly three o'clock."

The little pig said nothing, but at half-past two he started off for the fair. He bought a churn, and was rolling it home when he saw the wolf in the distance. Quick as lightning the little pig jumped into the churn to hide, and set it rolling down the hill. The hill was steep, and the churn came flying along at such a speed that the wolf became frightened, so he turned back and ran home as fast as he could.

Some hours later, when he felt braver, he went to the little pig's house.

"I was just on my way to call for you this afternoon," he shouted out, "when I met the most awful thing rolling down the hill all by itself. It gave me a horrible fright, I assure you. There must have been a witch inside."

The little pig burst out laughing, and he laughed so loud and he laughed so long that the old wolf got annoyed.

"I was the old witch," said the little pig, as soon as he could speak. "I spied you a long way off, and I jumped inside to save my skin."

This so enraged the wolf that he jumped up on to the roof and began sliding down the chimney. But it was baking day, and the little pig had made a huge fire. Down, down, down slid the wolf; there was nothing to save him. He sank right down into the fire, and was burned to cinders. And that was the end of the old wolf.

THE DOG THAT REMEMBERED ODYSSEUS

We have read some stories about the hero Odysseus, who is sometimes called Ulysses; and this is the story of his dog, whose name was Argus. Before Odysseus went away from his home in Ithaca to the great war with Troy, there was a puppy born, which grew to be a noble hound.

Odysseus loved Argus, and Argus loved his master. The hound would prick up his ears and give a joyful bark when his master approached. Then he would look at Odysseus with a world of love reflected in his eyes, and raise his head for the caress which always followed.

As Argus grew older he seldom left Odysseus for long. Like a shadow, he followed his master everywhere, except upon very long journeys. But before the hound was fully grown, Odysseus went away to the war, and was there for ten years. And still a long time passed, and Odysseus had many wanderings before he came again to Ithaca. And when he returned, being worn and travel-stained, there was no one who knew him again.

But when he came to the palace, there lay at the gate the ancient hound, Argus, very near death. Yet when the hound looked upon Odysseus, and heard his voice, he lifted his head and wagged his feeble tail. But more than that he could not do, for death came upon him there in the hour of his joy at the sight of his old master, whom none but he, the faithful companion, had recognised.

THE STORY THAT HAD NO END

THERE was a certain king who, like many other kings, was very fond of hearing stories told. To this amusement he gave up all his time; but yet he was never satisfied. All the exertions of his courtiers were in vain. The more he heard, the more he wanted to hear. At last he made a proclamation, that if any man would tell him a story that lasted for ever, he would make him his heir, and give him the princess, his daughter, in marriage; but if anyone should pretend that he could tell such a story, and should fail—that is, if the story did come to an end—he was to have his head chopped off.

For such a rich prize as a beautiful princess and a kingdom, many candidates appeared; and dreadfully long were the stories that some of them told. Some lasted a week, some a month, some six months: poor fellows, they all spun them out as long as they possibly could, we may be sure; but all in vain; sooner or later they all came to an end; and, one after another, the unlucky story-tellers had their heads chopped off.

At last a man came who said that he had a story which would last for ever, if his Majesty would be pleased to give him a trial.

He was warned of his danger; they told him how many others had tried, and lost their heads; but he said he was not afraid, and so he was brought before the king. He was a man of a very composed and deliberate manner of speaking; and, after making all requisite stipulations for time for his eating, drinking, and sleeping, he thus began his story:

"O king, there was once a king who was a great tyrant; and, desiring to increase his riches, he seized upon all the corn and grain in his kingdom, and put it into an immense granary, which he built on purpose, as high as a mountain.

"This he did for several years, till the granary was quite full up to the top. He then stopped up doors and windows, and closed it up fast on all sides.

"But the bricklayers had, by accident, left a very small hole near the top of the granary. And there came a flight of locusts, and tried to get at the corn; but the hole was so small that only one locust could pass through it at a time.

So one locust went in and carried off one grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn; and then another locust went in and carried off another grain of corn——"

He had gone on thus from morning to night, except while he was engaged at his meals, for about a month. Then the king, though a very patient king, began to be rather tired of the locusts, and interrupted his story with:

"Well, well, we have had enough of the locusts; we will suppose that they have had all the corn they wanted; tell us what happened afterwards."

The story-teller answered, very deliberately: "If it please your Majesty, it is impossible to tell you what happened afterwards before I have told you what happened first."

The king listened with admirable patience six months more, when he again interrupted him with: "O friend, I am weary of your locusts! How soon do you think they will have done?"

To which the story-teller made answer: "O king, who can tell? At the time to which my story has come, the locusts have cleared away a small space, it may be a cubit each way round the inside of the hole, and the air is still dark with locusts on all sides; but let the king have patience, and no doubt we shall come to the end of them in time."

Thus encouraged, the king listened on for another full year, the story-teller still going on as before.

At last the poor king could bear it no longer, and cried out:

"O man, that is enough! Take my daughter, take my kingdom, take anything—take everything, only let us hear no more of those abominable locusts."

And so the story-teller was married to the king's daughter, and was declared heir to the throne; and nobody ever expressed a wish to hear the rest of his story, for he said it was impossible to come to the other part of it till he had done with the locusts. The folly of the foolish king was thus stopped by the ingenious device of the very wise man.

THE FABLES OF THE BUDDHA

There was once a King of Persia who read that on the mountains of India was a tree which gave a medicine that brought the dead to life. The king sent his chief physician to India to get some of this medicine, and the physician met a wise man, who said: "Your king did not understand the book. By the mountains of India are meant the greatest of her wise men. The Tree of Life is the wisdom that grows from their minds, and their writings are the medicine which brings the dead to life." The wise man then gave the physician a book of fables. This book of fables has been translated into many languages. Some of its tales were composed by the Buddha, the great religious teacher, whose life is related on page 2995, and others were collected by Buddhist monks, about 2,300 years ago. Here are some of the stories.

THE STRONGEST THING

AN Indian magician was walking one evening by the bank of the Ganges, when an owl flew by, carrying in its beak a little mouse.

Being frightened, it dropped the mouse, and the Magician, who was a kind-hearted man, took the little creature home, and healed it, and changed it into a very beautiful girl.

"Now, my dear," he said, "I must find you a husband. Whom would you like to marry? I am a great magician, able to perform wonderful things, and I can carry out your slightest wish."

The adopted daughter of the Magician seemed pleased; her eyes twinkled.

"I should like to marry the most powerful being in the universe," said she.

"There is nothing in the universe more powerful than the Sun," said the Magician. "I will marry him to you." So he asked the Sun to marry her.

THE MAGICIAN CHANGED HER TO A MOUSE

"I am not the most powerful being," said the Sun. "Look at the great Cloud that covers me and hides my light. He is far greater and stronger than I."

"Well, you must marry my adopted daughter," said the Magician to the Cloud.

"There's somebody stronger than I," said the Cloud. "The Wind tosses me about just as he pleases."

But the Magician found that the Wind was not as powerful as the Mountain which towered, terrace upon terrace, right up into the sky, and stopped the fiercest tempest.

"And there's somebody stronger than I," said the Mountain. "Look at the Mouse which bores holes in my side, and lives there whether I like it or not. All my strength will not frighten him away."

The Magician was grieved at the result of his inquiries. He felt sure that his adopted daughter would never stoop so low as to wed a mouse. To his great surprise, however, she was delighted to hear that the Mouse was the strongest creature in the world. So the Magician changed her back into a mouse, the shape in which he had found her, and the two were very happily married.

You can alter anyone's appearance, but that does not alter their nature.

THE WISE AND FOOLISH FAIRIES

WHEN the Fairies of the Trees set out to choose their dwelling-places, some were wise and some were foolish.

The wise fairies shunned the trees that stood alone in the open fields, and settled in a thick forest.

But the foolish fairies said: "Why should we crowd together in a forest? Let us go and live in lonely trees near villages, where men will bring us gifts."

But one night a great tempest swept over the country. The lonely trees were blown down, and the foolish fairies became homeless. But the great, dense forest resisted the fury of the storm, and none of the trees there was injured. And the wise fairies said to the foolish fairies:

THE FOOLISH FAIRIES BECAME HOMELESS

"People should stand united like a forest. It is only the solitary tree growing unprotected upon the bleak downs or in the open fields that is overthrown or broken by a storm."

Union is strength.

THE CRANE AND THE WISE CRAB

A CRANE grew too old and feeble to catch the fish that lived in a lake close to his nest. So he resolved to do by cunning what he could no longer do by force. And he said to a crab in the lake:

"My dear friend, whatever will you and all the fishes do now? Some men are coming presently to drain every drop of water out of the lake. You'll all be caught and killed!"

On hearing this dreadful news, all the fishes assembled to try and find some way of escape.

"I have thought of a plan," said the cunning old Crane. "Of course, I eat one or two of you now and then; but I don't want you to perish in a heap for want of water. What good would that do to me? Now, there is a large pond just a few hundred yards away. Let me carry you, one by one, in my beak to this safe place."

The fishes got an old carp to go with the Crane and see if there was such a pond. The Crane took him very gently in his beak and showed him the new stretch of water, and then put him back among his companions, and when the fishes heard about the pond they cried:

"Very well, Mr. Crane; you can take us all with you!"

The cunning old Crane meant to take the fishes one by one in his beak, and eat them under a tree far away from the pond; but, unhappily for him, he began with the wise Crab.

"Come along," he said to the Crab, "and let me take you in my beak to the new pond."

"I don't like to trust myself in your beak," said the Crab. "You might let me fall and break my shell. We crabs have a famous grip. Let me catch hold of you round the neck, and then you can take me."

The Crane did not see that the Crab was trying to outwit him, and agreed to the proposal. But when the Crab was fixed on his neck, instead of going to the pond, he went to the tree.

"Where is the pond?" said the Crab.

"Pond?" said the wicked old Crane. "Do you think I'm taking all this trouble for nothing? The whole thing is just a trick for catching you and the other fishes, one by one, and eating you."

HE DROVE HIS CLAWS INTO THE CRANE'S NECK

"Just what I thought," said the Crab. And he drove his claws into the neck of the wicked old Crane, and killed him.

The wicked and the cunning are always caught in their own traps.

KING OF THE GOLDEN MOUNTAIN

A VERY long time ago there lived a rich merchant who had two little children, a boy and a girl. All his riches were in two big vessels on the sea, and he was expecting them home. But one day he was told that both ships were lost, so he had nothing left but a little field.

One day he was feeling very sad, and was walking in his field, when suddenly a very ugly dwarf stood before him and said: "Why do you look so sad?"

The merchant replied: "I have lost all my money, and all I have left is this little field."

Then the dwarf said: "Don't trouble any longer. If you will bring me, in twelve years from now, the first thing you meet on the way home, I will give you as much gold as you like."

"Yes," said the merchant, thinking that his dog would probably meet him on his way home, "I will do as you ask." But, to his great sorrow, his little boy ran to meet him.

A month passed, and the merchant thought to himself: "I have not got any gold yet; the dwarf must have been joking with me." But one day he went up to an old attic to get some iron he thought he might sell, and there on the floor was a great heap of gold. He was delighted to become rich again.

The years went by, and his little son grew up to be a young man; and then the father, remembering his agreement with the dwarf, grew very sad, and told his son that he had promised to give him to an ugly dwarf. But his son comforted him, and said: "Father, never mind your promise; I will not let the dwarf take me away from you."

So when the time came they went to the little field to meet the dwarf, and the son drew a round ring on the ground and stood inside it with his father. The dwarf soon came, and said to the merchant: "Have you brought me what you promised?"

But the old man did not answer, and his son said: "What do you want here?"

The dwarf answered: "I did not come to talk to you, but to your father, and I *will* have what he promised me."

Then they had a great quarrel, and at last it was decided that the merchant should put his son into a little boat all by himself on a large lake that was near. He thought that his son would be drowned, and went home feeling very sad. But the little boat went on and on, and at last stopped outside a beautiful castle, which was quite empty, for it was enchanted. The young man jumped out of the boat, and went through all the rooms in the castle until he came to one with a white snake in it.

Now the white snake was really an enchanted princess, and she was delighted to see him, and said: "You have come at last to save me. I have been waiting for you for twelve years. You must do exactly what I tell you. To-night twelve black men will come with chains hanging all round them. They will ask you why you are here, but you must not answer, even if they beat and hurt you. The second night twelve others will come, and the third night twenty-four more will come and cut off your head; but at twelve o'clock on the third night their power is gone, and I shall be free, and will come to you, and will wash you with the water of life to make you live again."

All these things happened just as the princess had told him, and the third night the white snake changed into a beautiful princess and married the merchant's son, and he became the King of the Golden Mountain.

They lived a long time together, and were very happy, and the queen had a little son. One day the king thought of his poor father, and he longed to go and see him again. But the queen did not want him to go, and said: "If you go, I know that something dreadful will happen." But he would not listen. So the queen gave him a wishing-ring, saying: "Put this on your finger, and it will bring you whatever you wish for; but you must promise not to wish for me to be with you when you are at your father's house."

The king promised to do as she asked him, and, turning the ring on his finger, wished to be near the town where his father lived. But the soldiers who guarded the city would not let him enter it, because his clothes were so different from theirs. So he borrowed an old shepherd's frock, and went to his father's house. But his father did not recognise his own son again, and said:

"You are certainly not my son, for he died a very long time ago."

Then the King of the Golden Mountain replied: "I am really your son. Is there no mark by which you can tell that I am your son?"

"Yes," said his mother; "our son has a mark like a raspberry under his right arm."

Then he showed them this mark, and they believed that he was their son. He then told them all his adventures, how he was a king, and was married to a beautiful princess, and had a little boy of seven years old.

But the merchant said: "You cannot be telling the truth. What king would travel about in an old shepherd's frock?"

Then the king was very angry, and wished that the queen and his little boy were with him, and they instantly stood before him. The queen was very angry, and said that he had broken his promise, and that ill-luck would come to them.

One day the king and queen went for a walk together, and the king showed her the place where he was put into the little boat. Then, feeling very tired, they sat down, and he went to sleep. The queen, wishing to punish him for having broken his promise, took the wishing-ring off his finger, and wished herself and her son back at the castle. When the king awoke he found himself alone, and saw that the ring had gone from his finger. He said to himself: "I can never go back to my father's house; they would say that I was a sorcerer. I will go a long journey to discover the whereabouts of my kingdom."

THE DWARFS ILL-TREATED AND TORTURED HIM, BUT HE REMAINED SILENT

So he started off, and walked on till he came to a mountain where three giants were quarrelling over their inheritance. When they saw him pass they said to each other: "Little men have sharp wits; he shall divide the inheritance between us."

This inheritance was a sword which could cut off anybody's head when the wearer said "Head's off!" a cloak that made the owner invisible, or gave him any form he pleased; and a magic pair of boots that took the person who put them on to wherever he wished to go.

The king said to the giants: "I must try these wonderful things first; then I shall be able to decide for you."

Then they gave him the cloak, and he wished himself a fly, and he immediately became a fly.

"The cloak is all right," he said; "now give me the sword."

"No," said they, "not unless you promise not to say 'Heads off!' If you do, we shall all become dead men."

So the king tried its magic power on a tree standing hard by.

He then said: "Give me the boots to try, too." And directly the clever king got all three he wished himself at the Golden Mountain, and he was there. As the king came near his castle he heard merry music, and the people round about told him that his queen was going to marry another prince. When the king heard this he was very angry, and put his cloak round him, and went to the castle. A great feast was being held, and the king sat by the queen, and when anything was given her to eat and drink he took it away from her. When the queen saw this she was very frightened, and went away to her own room, the king following her.

"Alas!" she said to herself, "I am still in the power of some enchantment."

Then the king took the cloak off, and said: "I did save you, but you deceived me. Have I deserved this bad treatment from you?"

Then he went out and told all the merry-makers to go, and said the wedding would not take place, as he was the right king. Then the princes and nobles laughed at him, and tried to seize him; but the king drew his magic sword and cut off all their heads.

So he became once more King of the Golden Mountain, and lived happily with his queen and son ever after.

NAPOLEON'S WONDERFUL ESCAPE

It is interesting to know who made the first infernal machine. The name comes to us from the French, and the first *machine infernale* was directed against Napoleon. It consisted of a barrel of gunpowder, and it was placed on a cart, to which it was strongly bound by cords, with grape-shot piled round about it, and with a slow-match attached to the powder. The conspirators were Bourbons, who wished to get Napoleon out of the way, so that the monarchy might be restored. The night of the outrage was December 14, 1800.

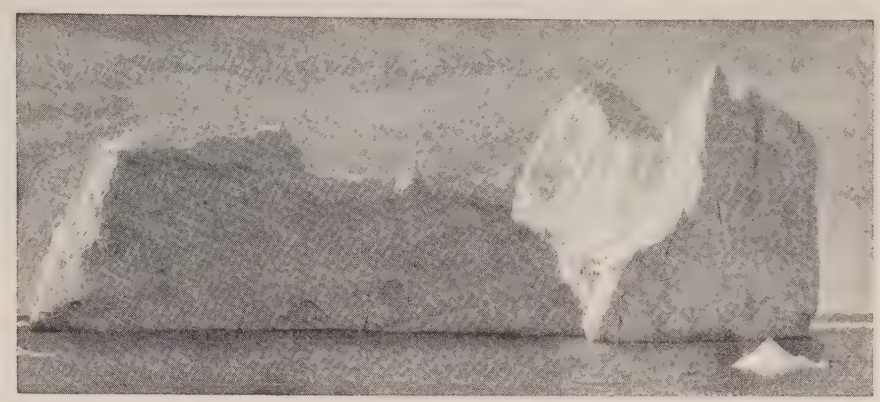
On this night Napoleon was going to the opera. The conspirators wheeled their carriage, which had been prepared by a man named Georges Cadoudal, into the Rue Saint Nicaise, and waited for the procession to go by. At the right moment the match was ignited, and some of the conspirators actually stood by to watch the havoc of the explosion. The match burned a trifle slower than these monsters had imagined. The carriage containing Napoleon passed the loaded cart. But hardly had it gone by when a terrific explosion took place. The street was immediately plunged into darkness. The crash of shivered glass and rolling stone mingled with cries of agony and terror. Twenty people were struck dead. Fifty-three, including the conspirator who had lighted the match, were horribly wounded. The whole neighbourhood was thrown into the most frightful panic imaginable.

Out of the quiet night, in the centre of happy Paris, and far from scenes of war and death, there had suddenly leaped this terrible thing of slaughter and destruction, scattering agony and death among innocent women and children, and filling the minds of people with the madness of terror. That is the reason why the French gave to this wicked invention the name of *machine infernale*, or infernal machine. Napoleon escaped without injury; but never was he in such great peril.

The next Stories are on page 4271.

MOUNTAINS OF ICE FLOATING IN THE SEA

In these pictures we see some of the fantastic forms that are taken by the great icebergs that float down from the north into the Atlantic and Pacific Oceans. Icebergs have the appearance of dazzling chalk cliffs. Their height above water is sometimes 250 feet, which means that under the water they reach to a depth of more than 2,000 feet. Icebergs often carry to sea great boulders and piles of smaller stones, and even Polar bears are sometimes seen making a dangerous voyage on an iceberg. When the ice melts they sink in the sea and are drowned



WHY DOES AN ICEBERG FLOAT?

CONTINUED FROM 4121

IF we were to judge by almost every other case we know, we should say that an iceberg must certainly sink. The rule is that when anything is cooled it gets denser—that is to say, heavier in proportion to its size. In other words, it contracts. If this were true of water, ice would have to sink, and our earth would not be the earth we know.

Water certainly contracts as we cool it down to four degrees centigrade above the freezing-point. But from this point downwards water expands instead of contracting, so that ice is slightly lighter than the water around it. The difference is not very great—it is just enough to allow an iceberg to float with about seven-eighths of itself below the surface of the water and one-eighth above it.

In the Antarctic Ocean one may see icebergs that are actually miles across, and they may rise two or three hundred feet above the surface of the water. But the laws that govern floating must always be obeyed; and if we remember that there must be seven times as much ice below the surface as shows above it, we shall get an idea of the enormous size that masses of ice sometimes attain. The part below the surface is, of course, surrounded by liquid water, which is warmer than the ice. Consequently, by the laws of heat, there must be a flow of heat from the water to the ice, which therefore melts. The result often is that, after a time, owing to the destruction of the foundations, so to speak, the iceberg capsizes, and a new part of itself shows above the surface.

It has been lately proved that when ice is made very cold indeed, a point is reached when it begins to behave as other things do, and shrinks as it cools. But, fortunately, this point is far below any temperature that occurs naturally on our earth.

HOW DO FISH LIVE IN A FROZEN POND?

Ordinary ice, we know, is lighter than water, and therefore it floats. So what we call a frozen pond is a pond of which the surface is frozen. Skaters are perfectly aware of this. They want to know how thick the ice is, for they know that there is liquid water underneath it. So when we speak about fish living in a frozen pond, we mean fish living in liquid water that has a layer of frozen water above it.

The really serious part of this for the fish is not, as we might think, the coldness of the water they are in, but the question how that water is to be supplied with enough air for the fish to live by. When a pond is not frozen, oxygen from the air above it

is passing into the surface of the water as fast as it is being used up by the fish and other living creatures in the water.

When a pond is frozen, this process is very nearly stopped. There may be gaps in the ice here and there—air-holes, such as air-breathing creatures will make in the frozen North—but perhaps there may be none of these. A little oxygen may get through at the edge of the ice, but the best hope for the fish is that there is a supply of new water coming into the pond below the ice from somewhere else, and bringing enough oxygen dissolved in it to keep the fish alive. If the supply of oxygen is kept up in none of these ways, then, when there is no more of it left, the fish will surely die, as must every living creature that is prevented from breathing, whether it be man, mammal, bird, reptile, fish, moss, or microbe.

HAVE FISHES ANY FEELING?

Certainly they have. Everything that lives, from a microbe up to a man, has some kind of feeling. The power to feel and to respond to what is felt is a mark of all living matter everywhere, and its disappearance without return is the mark of death. But the amount and the quality and the clearness of feeling differ widely in various living things. So it would be equally wrong to say that a fish has no feeling, and to say that it feels as we do. It does feel, but it does not feel as we do.

Seeing is a kind of feeling, and perhaps a fish sees quite as well as a young baby does. A fish hears, too, and smells and tastes. Also, a fish certainly has the sense of touch. It can suffer a kind of unpleasant feeling, too, and must do so, for instance, when it has a hook in its mouth; but it would be a great mistake for us to fancy that it feels sharp pain as we should if we had a barbed hook in our mouths.

A fish has only a very simple kind of brain, and cannot feel so keenly as we do. So as to whether it is right to fish, I think we should decide for ourselves, and act accordingly, but not condemn or ridicule people who differ from us in their opinion on the matter.

WHY IS SUGAR SWEET?

This is a question which can be answered *in a way;* and yet cannot be really answered at all. We know that there is a certain well-marked part of the surface of the brain which is the real seat of the sense of taste. From, or to, this place there run at least four, perhaps more, sets of nerves, which at their other ends we find in the "taste bulbs" of the tongue and part of the throat. One set of these nerves, when it is excited, arouses in the brain the feeling which we call a sweet taste, and the thing which specially excites this particular set of nerves is sugar. So, *in a way,* that is the answer to the question.

But no one has the least idea why sugar should not taste salt, or why salt should not taste sweet or bitter; nor is there any imaginable way of describing a sweet, a salt, or bitter, or acid taste to anyone who does not know these tastes. We cannot even know that other people taste sugar or anything else just as we do.

"Sugar" is really a name for a closely related group of chemical substances, all of which are sweet tasting, though some are less so than others—for instance, milk sugar. But saccharin, which some people use instead of sugar, is utterly different from sugar chemically, yet it is sweeter than any sugar.

WHY DOES HOT WATER CLEAN THINGS BETTER THAN COLD?

When things are dirty, especially our skin, or our clothes, or the plates we have eaten from, the chief cause of the dirt, and the chief difficulty in getting things clean, is fat or oil. If we try to clean an oily plate with cold water, we cannot doubt this. Fat and oil are great catchers of dirt, and if we wash our fingers perfectly clean, and then rub a little butter on one hand, but not on the other, five minutes will show a great difference between the two hands.

Fat is simply solid oil, and oil is liquid fat. Whether the thing shall be solid or liquid is decided by the amount of heat in it. If it is hot, it is liquid, and then it can easily be got rid of. Hot water turns solid fat and half-solid fat into a liquid oil, and that is the reason why it cleans things better than cold water.

If the thing we have to clean has no fat or oil in it, we shall find that whether we use hot or cold water matters very little. But the mere fact that we commonly use our bare hands for washing things makes hot water more

useful, as our hands themselves are producing a quantity of fat or oil all the time except when they are bitterly cold.

WHY CANNOT ORDINARY GLASS BE BENT?

All we can say is that different kinds of matter have different properties; some matters will bend, or be hammered into thin sheets, or be drawn into long wires without breaking, while others will not. The differences depend on the way in which the molecules of the thing in question are joined to each other. Glass is one of the things that are rigid and brittle, while clay, for instance, can be bent or moulded into any shape.

But it is very interesting to find that the same thing may sometimes be brittle and sometimes plastic, according to circumstances, and the most important of these circumstances is the temperature. Glass itself gives us an instance of this. It is quite true that glass, as we know it, will not bend—or, rather, that it will not bend much.

If we make the glass hot—red hot, or a little less than red hot—it will bend quite readily into any shape we please. Then we can cut it with scissors, or draw it out with pincers, or mould it into any shape we like. This is the general rule with a great many things which are rigid and brittle when they are cold. It must mean, of course, that when the glass is made very hot, its molecules do not hold on to each other so tightly as they do when they are cold.

WHY DOES THE STREAM RUN MOST SWIFTLY IN THE MIDDLE?

The water at the side of the stream is constantly being held back by rubbing against the banks, just as the bottom of a wave is held back when it reaches the shallow water near the shore. And so, compared with the water near the sides, the water in the middle of the stream runs more swiftly. It is held back a little by rubbing, or friction, between it and the slower moving water at the sides; but the friction between water and water is very much less than the friction between water and anything that is solid, such as the banks of a stream.

When we watch the blood running in a blood-vessel, we see exactly the same thing. In the middle of the stream we see the tiny red and white cells tumbling fast over each other as they scurry along. But near the walls of the blood-vessel they move much more slowly, for they are held back by the friction of the wall, even though it is beautifully smooth. And just the same thing happens with smoke going up a chimney, and in many other cases. We should always try to think, when studying such a question as this, of other cases where the same principle of friction is really at work.

WHY DOES BOILING MILK FLOW OVER THE TOP OF THE SAUCEPAN?

When any liquid boils, what happens is that parts of it are changed into a hot gas. This is much lighter than the liquid in which it is formed, and so it rises to the top as a bubble, and there the bubble bursts and the gas is given off into the air. When a bubble formed at the bottom rises through the liquid unbroken until it reaches the top, and bursts there, we say that the liquid is boiling.

In the case of water, which is all made of one thing, there is nothing to prevent the bubble from reaching the top of the boiling water and bursting there. So, though the surface is raised everywhere for a moment by bubbles which have half freed themselves, the water does not boil over. But milk is a mixture of a great many different things, some of which can boil, and some cannot. What really boils in milk is the water, which, after all, makes up the greater part of it.

At least one of the things in the milk turns solid and forms a skin on the top of the milk when it is heated. This skin is made of one of the valuable proteids of the milk, and it is great waste not to eat it. Now, when the bubbles of water-gas reach the surface, they find themselves imprisoned by this solid skin that is forming, and they lift it up, just as the hot air may lift a toy balloon, so that, as we say, the milk boils over. If we carefully stir it, we may prevent this.

IS A FLY, IN COMPARISON WITH A MAN, REALLY THE STRONGER OF THE TWO?

Everyone will know what this question means, and yet it is not quite rightly put. So far as the words go, the question might mean, if you compare a fly and a man, which is the stronger? But we know that what the question really means is this: 'Is a fly really stronger than a man relatively to its size, or in proportion to its size?" The answer is certainly yes. The last thing in the world that distinguishes

man is bodily strength of the kind which is shown in lifting weights, and so forth. It is by *skill*, made not by the muscles, but by the brain, that man lives on the earth—skill, not strength. If we weigh the proportion of the bodies of different animals that is made of muscle, and if also we weigh the proportion that is made of brain, then we learn how muscle has been getting less and less important, while brain, with all that brain means, has been getting more important. Not only a fly, but animals in general are the superiors of man so far as muscular strength is concerned; but then the question of muscular strength is an inferior one, and man is master because of what really matters, which is mind. The race is not to the swift, nor the battle to the strong, but to the wise, who will use their brains.

WHAT MAKES THE WHITE MARKS ON OUR NAILS?

Our nails are made of a very special kind of horny material. It is in some ways like the material that makes the outer skin; it is also still more like part of the material that makes the hair; but it is different from either of these, and comes closer to horn than any other part of our body does. It is made by special cells of the deeper part of the skin at the base of the nail, and our nails, therefore, depend entirely upon the perfect health of these cells.

In cases where a person's skin is not in health, it is very commonly found that the nails suffer, dropping out or becoming cracked or brittle; and if for any reason the blood is out of order, and so supplies what is not quite suitable, or may even be poisonous, to the cells at the base of the nail, their work will be interfered with, and though they may go on producing nail stuff, it will not be quite what it ought to be.

In this way we can often see white marks across the nails, sometimes on all the fingers of both hands, corresponding to the date when we were out of health, and when the proper nail substance could not be made. The toe-nails may also show indications of these white marks, as we should expect.

WHAT IS AT THE END OF SPACE?

It is not often that we can answer a question about the outside world by looking into our own minds and seeing what they tell us. Indeed, for many ages the progress of knowledge was stopped because men thought they could discover things out of their heads instead of looking to see what Nature said. But this is a question which we can answer out of our heads; we do not need to go to the end of space to answer it. We find, directly we begin to think of the end of space, that there must be more space beyond it. It is impossible for our minds to think of the end of space. Directly we try to do so we are bound to think of more space beyond it. There is no way out of it. In the same way, we cannot think of the beginning nor yet of the end of time. However far back we like to go in our minds, there must have been a time before that, whatever it was; and so, if the world came to an end, as we say, there would still be the time after that event happened. We are bound, by the very nature of our minds, to think of space as infinite, and of time as infinite, too. *Finis* is Latin for end, and infinite literally means unending.

WHY DO WE GET A HEADACHE IN A CROWDED ROOM?

We do not get a headache in a crowded room if it is properly ventilated; only, of course, it never is, and if any one of us is the only person in the room, a headache will very likely come on if the room is small and shut up so that the air cannot be changed. There is no question that it is the foul air which causes the headache. The reason why the crowding of people together has this effect is that it is the people themselves who make the air foul.

Every living thing, without exception, gives off to its surroundings, in one form or another, products of its life which are worse than useless to it, and which it must get rid of. The most elegant people, spotlessly clean and scented, are no exceptions to the rule. There is a good deal of doubt as to what precisely the things are which produce the effects of foul air. It is possible that gases given off from the skin, especially if it is not very clean, may contribute.

But probably the carbonic acid which we all breathe out into the air is the chief cause. At any rate, it is certain that the air of an unventilated room soon comes to contain a number of gases which, as we breathe, we get

into our blood—gases which have been breathed away from our blood and the blood of other people, and which, as they get heaped up in it, and as they pass through the brain, poison it. Probably they cause headache by weakening the walls of the little blood-vessels inside the brain, so that they get too full of blood, which is moved on too slowly. That causes pain, just as the same state of affairs causes pain in a poisoned finger, or in any part of the body where the circulation of the blood is made to stand still.

WHY DOES THE HAIR STAND ON END WITH FRIGHT?

We know that both in ourselves and in many of the lower animals the hair can, and does, stand on end with fright, almost "like quills upon the fretful porcupine," as Shakespeare says. It is also true, as he says, that it is possible for "each particular hair to stand on end," for we find that every hair has the power to do this, and that what happens is not that several hairs stand up together as the result of pulling on the skin. At the root of the hair we find a tiny muscle so arranged that, while the hair usually lies slantwise, when this muscle pulls, the hair stands upright.

The best reasons we can give for this peculiarity are that this movement may help to keep the root of the hair in order by a sort of massage, or that it may serve in keeping the skin clean, or, most likely of all, that it may make such an animal as a cat, when its hair is standing on end, look very much bigger and more terrible to an enemy.

WHY DO WE FEAR BEETLES OR SPIDERS WHEN WE KNOW THEY CANNOT HARM US?

This is one of the most interesting of questions, because the answer to it takes us right into the depths of our minds. What we call our reason, or intelligence, is in many ways the highest part of our minds, but it is not the whole of them. It is, in a sense, a new thing, and its power is limited by the fact that there are other parts of the mind, far more ancient, which have to be reckoned with as well. Most of these we may simply call instincts, and again and again we find, when we observe ourselves and other people, that the instinct of curiosity or of flight decides our actions quite apart from our reason, and quite apart from what we know, or do not know, in the particular case. Very often indeed the part of us that knows does little more than just sit still, so to speak, and look on and notice what the rest does. If we think, we shall see that we could not live if we had only our reason. To begin with, a baby would not suck, for there would be nothing to make it do so; and so it would be in a hundred ways throughout life.

But often our instincts may mislead us, though most usually they guide us rightly, and so we may have the instinct of flight and the feeling of fear, which goes with it, when we see a beetle or a spider; and then we may be able to notice that, whatever the knowing part of us says, there is something else in us, older and stronger, which has its way and makes us afraid. Even now it is highly desirable that we should dislike crawling and creeping things; many may be harmless, but many others are very dangerous in various ways; and, on the whole, this instinct is a very useful and wise one for us to have.

WHAT MAKES THE POISON IN A SNAKE'S FANG?

A snake's fang is an eye-tooth, or canine tooth, as it is called, corresponding to the sharp pointed teeth that we have at the corners of the jaw between the front teeth and the back teeth. In the case of the poisonous snakes, the tooth has a special channel in it through which the poison can run when the snake bites. The snake, like ourselves, has certain glands, but in our case these simply produce the saliva, which helps us to chew and digest our food.

In the snake, however, these glands do much more than that, and especially the gland which corresponds to the one we have in front of the ear, the one which gets so big and painful when we have mumps. In the snake the business of this gland is to produce the poison. It runs along a little tube from the glands on each side of the mouth to the poison teeth. When the snake bites, the muscles of the jaw, which make the teeth meet, also squeeze upon the glands in these tubes in such a way that a little of the poison is forced through the channel in the fang, and left in the victim's body. The amount of poison thus injected is, as a rule, exceedingly tiny, but the

venom, or poison, of many of the venomous snakes is among the most deadly of all poisons, and a mere portion of a drop will kill. This is a deeply interesting question from the widest point of view, because it is so remarkable to discover that, in certain kinds of animals, parts of the body which are possessed by so many other kinds of animals, and which were certainly evolved for one purpose in the first place, are turned to a quite new and special purpose in these particular cases. In non-poisonous snakes, these same glands, which are so poisonous in the venomous snake, look just the same, yet produce nothing to hurt anyone.

HOW DID ALL THE METALS GET INTO THE EARTH?

If this question had been asked ten years ago, no one could have made any better answer than that the various metals were in the stuff from which our earth was formed ages ago, and that by some chance or other they just settled down in the earth's crust—one here and one there. But quite lately we have had to give up for ever ideas of this kind.

We are beginning to understand that change is going on everywhere. This is true of worlds; it is true of plants and animals; it is true of nations and their ways; and, for instance, it is true even of the atoms of the elements. So now, when we find gold in some part of the earth's crust, or silver, or lead, or whatever it be, instead of saying that these were always there, we inquire into their history and find out how they came to be made, just as if we were studying the remains of some animal or plant.

For instance, we have little doubt that all the lead in the world is the result of a long series of changes that began in an element called uranium, and that stages in between uranium and lead are represented by the element called radium and the beautiful and precious metal which we call silver. It will not be very long before chemists are able to work out the history of many metals, and even to discover what will happen to them next.

WHEN WE DIVE WHY DO WE ALWAYS RISE TO THE SURFACE?

This is not a very easy question to answer. For one thing, it is possible to dive and not rise again. This may very easily happen when a man dives from a height into shallow water, and does not do the right thing when he gets under. He may then strike the mud at the bottom and stay there. That is the danger of diving from too great a height into shallow water. In such a case the diver's body would naturally go deeper than the water before it came up again. The secret of his success is that he turns his hands after he enters the water, and so changes his course.

Apart from this, the reason why the diver comes up again is to be found partly in the action of his arms and legs under the influence of the powerful instinct to get to the air again, and partly in the elastic rebound of the water after he has struck it. We must also remember that the pressure of the water gets greater with every descending foot; and the diver's body, filled as his lungs are with air, is scarcely, if at all, heavier than the water itself.

The case at once becomes different if he is injured, or if he is a drowning person unaccustomed to water, who breathes out into the water the air of his lungs, and then breathes water in. That is quite as bad as letting water get into the air-tight compartments of a boat.

DOES A TADPOLE KNOW IT WILL LOSE ITS TAIL?

Certainly we cannot speak of a tadpole, or any such creature, knowing anything in any such way as this question suggests. A tadpole, a fish, an insect may know, in the sense of recognising, a thing that it has seen before, and remember whether it is nice or nasty. A dog, an animal of very high intelligence compared with a tadpole, may know when its master is angry; may know when it is doing a thing which is disapproved of. But not even a dog can ever *know* in the sense suggested by this question.

Let us consider what the point is. If a tadpole is to know that it will lose its tail, this means that it has arrived at the idea of itself as I, and that it is able to think of itself in the future and what will happen to it. In other words, the tadpole must be conscious of itself. But this consciousness of ourselves, or self-consciousness, is found in no living creature but man, and is, beyond all other things put together, the fact which distinguishes man from every other form of life on the earth.

Even a human baby does not have self-consciousness. Tennyson has said :

The baby new to earth and sky

. . . . . .

Hath never thought that this is I.

When a baby learns to talk, it first speaks of itself as baby, and only gradually discovers itself, and speaks of I. Then it has become really human. If a tadpole knew that it would lose its tail, the power to do that would at once place it on a level with ourselves : it would be no tadpole.

WHAT MAKES THE CATERPILLAR TURN INTO A BUTTERFLY?

Whenever we ask about any fact of a living thing, we have to make our choice and balance more or less between the effects of its own nature and the effects that its surroundings work upon it. In the case of this question, everyone will agree that the important thing is the nature of the caterpillar.

By altering its surroundings as regards temperature, light, moisture, and so on, we can hasten, or retard, or slightly affect in other ways, the change that occurs to the caterpillar. But such experiments as this only make it more clear that the real cause of what happens is to be found in the nature of the caterpillar itself. Now, if we look at a caterpillar and do not think of what it will become, we shall agree that it is in most respects a sort of worm. On the other hand, if we look at the butterfly and forget what it was, we shall agree that it is a sort of insect.

There is a vast difference between a crawling worm and a flying insect. Now, if we look at a tadpole, we shall agree that it is a kind of fish, breathing the air dissolved in water, like other fishes ; but a frog is no fish, and breathes air as we do. The explanation, we believe, is that the frog, and all creatures like frogs, are descended from fishes, and so in its earliest stages each of them is a fish. So also we are bound to believe that the insects are descended from the worms, and that is why the caterpillar turns into a butterfly. In a large book it might perhaps be possible to begin to do justice to this question.

WHY IS IT DARKEST JUST BEFORE DAWN?

We ought to begin by asking : Is it darkest just before dawn? There is probably very little ground for this belief. At any rate, we may be quite certain that in all cases like this, where we compare darkness and lightness, or loudness and softness, it does not do to trust to the evidence of our senses, because they do not judge fairly.

There are various ways by which we can measure the brightness of light. In order to prove that it was darkest just before dawn, it would be necessary to use some kind of light measurer—not our eyes—and compare the amount of light it recorded just before dawn with what it recorded previously. Our eyes and senses in general do not judge things on their own merits, but always by comparison with other things.

The proper way to say this is that all our sensations are relative. A room may be light relatively to a room that is less light. If we go to the room from darkness we call it bright ; if we go to the room from blazing sunlight we call it dark. And so we judge the darkness before dawn by the dawn. When the light begins to come into the sky, we think how very dark it was just before.

WHY ARE THE NAMES OF CHEMICALS AND PLANTS WRITTEN IN LATIN?

Latin is now what we call a dead language—that is to say, no living nation speaks Latin, though, in point of fact, one-third of English, for instance, is really Latin. The time was, of course, when Latin was a living language, spoken by the most important people on the face of the earth at that time. They had names for many chemicals and plants, many of which names we use to-day.

But long after the downfall of Rome, Latin remained the language of scholars ; it was the one language known to all learned men all over the civilised world ; they always wrote their books in it, and lectures were always delivered in Latin. It was thus possible for an Italian, shall we say, to visit England and lecture to the Englishmen at Oxford in a language which was neither his own nor theirs, but the common tongue of the learned.

So it naturally came about that when the great Swede Linné, usually known by the Latinised form of his name, Linnæus, began to name and classify plants, he gave them Latin names. The convenience of Latin for such purposes is as great now as ever it was.

The next Questions are on page 4337.

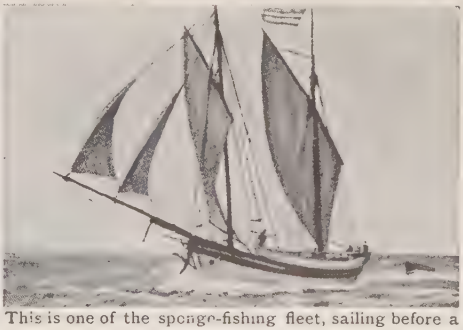
THE LIFE OF A SPONGE

It is odd to think that the sponge we use in the bath was once alive, but so it is. The sponge lives in the sea, breathing oxygen like a fish. Water is drawn into it through little pores, and the food the water contains is extracted by cells, the water, which has no value, passing out by the big holes which we see in the sponge. They are really coasts, and in them worms and tiny shellfish, and even small crabs, make their homes.

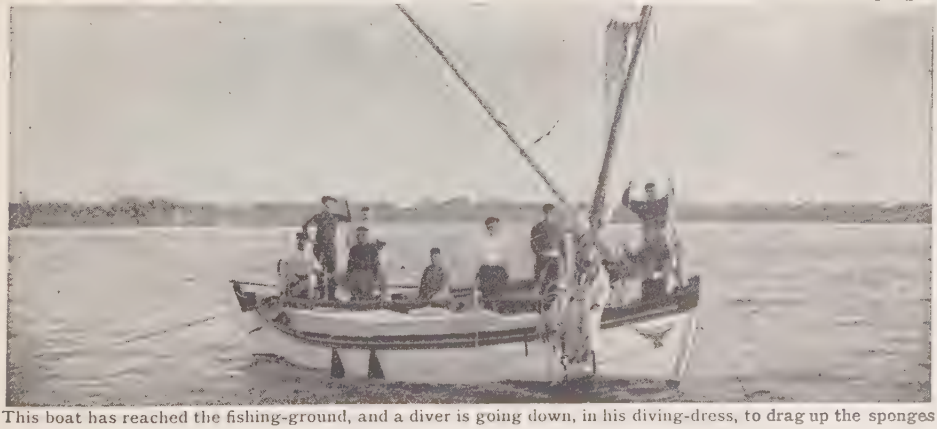
WHERE THE SPONGES COME FROM

Here is a sponge-fishing fleet being got ready in the harbour of Hydra, Greece, to sail for sponge-fishing. The sponges live in warm, tideless seas off the coasts of Turkey and Greece, off Florida in America, and off the Bahama Islands and West Indies. They make their homes upon rocks, or on the mud, or even upon other animals.

The fleet has started, and here we get a view of the inside of one of the boats, and the fishermen at ease.



This is one of the sponge-fishing fleet, sailing before a favourable wind towards the home of the sponges.



This boat has reached the fishing-ground, and a diver is going down, in his diving-dress, to drag up the sponges that lie from 40 to 60 feet below the surface of the water. The tube which we see to the left of the diver will send down fresh air for him to breathe. He will uncoil the rope in his hand so that it may serve as a guide to him in the water, and by jerking the rope he can signal to his comrades to pull him up with his sponges.

THE SPONGE-DIVERS AT WORK IN THE SEA

Here we see the boats on the sea, and the divers in the water, stripping the sponges from the rocks. The men who wear diving-dress can stay under water for hours. The man who is diving from the boat on the left has no diving-dress. He will not be able to stay in the water more than two or three minutes, or he would be very ill.

Here the sponges are being roughly cleaned after being brought ashore by the boats. There is a thin skin over the sponge, and in all the pores and canals is a slimy, sticky substance, which is the life-matter of the sponge. The skin has to be removed, and the sticky substance squeezed out to make the sponges clean and fit for sale.

This is a scene in Florida, to which a sponge-fishing fleet has returned. The sponge-fishers build the enclosures of timber in the water which we see here, so that in them they may store their newly-caught sponges. The action of the water makes it more easy for the fishermen to remove the slime and skin of the sponges.

PREPARING SPONGES FOR THE BATH

Here are the sponges brought in from the fishing-ground at sea by the two boats which we see on the left and right of the picture. They are big, good sponges which have been gathered by hand from the depths of the sea. Some divers tear the sponges away with pronged forks, but this spoils the sponges, and they are sold at low prices.

The sponges, having been washed and cleaned, are put out to drain on wooden racks, and then sent from this place in Florida to be sold. They are carried away by steamships, many of them going to Europe. Sponges are valuable not only in the bathroom, but some are used in treating patients in our hospitals.

The photographs in these pages are supplied by Messrs. Cresswell Brothers & Schmidt, London.

THE NEXT PICTURES OF FAMILIAR THINGS BEGIN ON PAGE 4425

WONDERFUL WORK OF THE WAVES

Photograph by [illegible]an, Montreal.

In the Bay of Fundy the tides rise higher than anywhere else in the world, and to these tides are due the fantastic forms of these rocks at Hopewell Cape, New Brunswick. The rocks themselves are of red sandstone and the forms are so curious that thousands have taken the drive of eight miles from Hillsboro to see them. Their size can be measured by the height of the man standing at the base of the larger one.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Marjorie avait un poney qui s'appelait Jean, à qui elle donnait à manger.
Marjorie had a pony which itself called Jack, to which she gave to eat.
Marjorie had a pony called Jack, whom she used to feed.

Un jour que Marjorie courut à l'écurie elle trouva la porte toute grande ouverte
One day that Marjorie ran to the stable she found the door all great open.
One day when Marjorie ran to the stable she found the door wide open.

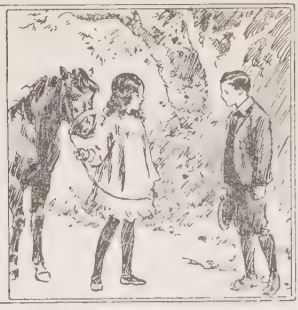
Elle regarda dans l'écurie, mais Jean n'y était plus. Où était-il parti ?
She looked into the stable, but Jack not there was more. Where was he departed?
She looked into the stable, but Jack was not there. Where had he gone ?

Marjorie courut dehors dans tout le sentier pour le chercher.
Marjorie ran outside into all the lane for him to look for.
Marjorie ran out into the lane to look for him.

Jean était là, et il y avait un pauvre petit garçon assis sur son dos.
Jack was there, and it there had a poor little boy seated upon his back.
There stood Jack, and sitting on his back was a poor little boy.

" Mauvais garçon d'avoir volé mon poney," dit-elle. " Autrefois il était à moi.
"Bad boy of to have stolen my pony," said she. "Other time it was to me.
" You bad boy to steal my pony," said she. " He was mine once.

Quand nous sommes devenus pauvres mon père vous l'a vendu," dit le garçon.
When we are become poor my father to you him has sold," said the boy.
When we became poor my father sold him to you," said the boy.



" Et j'étais si heureux de le revoir que j'ai sauté sur son dos."
" And I was so happy of him to see again that I have jumped upon his back."
' And I was so happy to see him again that I just jumped upon his back."

" Pauvre garçon," répondit Marjorie, " je vous le prêterai quelquefois."
" Poor boy," replied Marjorie, " I to you him will lend sometimes."
" Poor boy," replied Marjorie, " I will lend him to you sometimes."

" Merci bien ! " Le petit garçon courut chez lui heureux comme un roi.
"Thank you well!" The little boy ran to the house of him happy as a king.
" Oh, thank you ! " And the little boy ran home as happy as a king.

GAMES FOR A CHILDREN'S GARDEN PARTY

Of the many games that can be played at a children's garden party, none is more amusing than balloon breaking on "horseback." Each player must get a grown-up friend to act as horse, and must be armed with a long, pointed stick to use as a lance or spear.

In the game of balloon breaking the player wins who with his stick, breaks the balloon, which is fastened to a piece of string. A player on foot runs round with the balloon, jerking it about to prevent it from getting broken, and a great deal of the fun depends on his skill.

A human wheelbarrow race is always exciting, for there are generally some spills that cause much laughter. The course should be not more than thirty yards long, and we see here the correct way for competitors to stand at the start. As soon as the signal is given they start.

A toy motor or tricycle race is good. Each competitor has a partner half-way down the course, who throws a ball as the cyclist comes up. The cyclist catches this, cycles to the end, drops the ball in a bucket, and returns. The player who first completes his task is the winner.

An Indian race is always popular. The competitors run to a tent fifty yards away, where each finds an outfit consisting of a head-dress, belt, arm-pieces, and anklets of feathers mounted on strips of red cloth These are put on as quickly as possible and the competitors then race in and out of a line of flags, without knocking any down, and thence to the winning-post, fifty yards farther on. The left-hand picture shows the competitors as they leave the tent, running among the flags, and on the right we see the winner of the race arriving home.

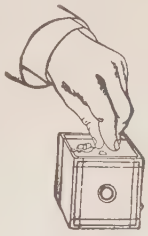
USING A BROWNIE CAMERA

CONTINUED FROM 4146

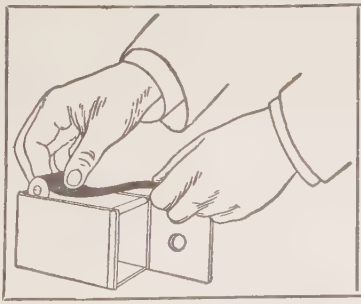
PHOTOGRAPHY is one of the most interesting of all hobbies, for it enables us to keep a pictorial record, that is, a record in pictures, of the places we visit during our holidays, and of anything that happens to us, or to those around us.

In taking up photography as a pastime we had better begin with a Brownie Kodak. It is one of the simplest and most inexpensive of cameras, costing only one dollar, and it gives perfect little pictures that can easily be enlarged should it be necessary.

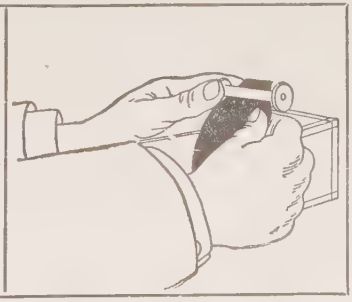
Besides the camera, we shall require the materials for developing the films and printing the pictures. For a dollar or two we can get a complete outfit consisting of a folding lamp, three developing trays, a glass beaker, a printing frame, a rod for stirring the powders, two developing powders, a quarter of a pound of acid hypo, one dozen papers for printing the pictures, a package of bromide of potassium, and a package of alum. All these articles we can buy separately from the druggist if we prefer it. We should also purchase a tiny view-finder, which will cost only a small sum. One great advantage of the Brownie is that it can be loaded in daylight. This does away with the necessity of going to a dark-room every time we want to put in a new roll of films. In loading the camera we place it upon a table as far as possible away from a window, for although we can load it in the daylight, it is wise to work in a subdued light. We unlock the camera by turning the nickel catch to the right, as shown in figure 1. By doing this we release the winding key, which we must remove from the camera. Then, holding the camera with the clasp side upwards, and the end containing the tiny red window away from us, we slide the nickelled clasp to the right, raise the outer edge of the clasp, and so open the little door at the back. Inserting the finger in the circular hole in the inner flap, we raise it to a horizontal position, and with a gentle pull remove the part of the camera that holds the roll of film. We shall find that there is a brass spool-clip at each forward corner that just holds a spool of film. An empty spool is seen on the right side, and this we must use as the reel. A hinged flap with a hole in the centre is at the rear of the roll-holder, and we must see that this flap comes *behind* the film when we load the camera. Laying the holder on its side, we take up a cartridge, and break the slip that holds down the end of the black paper. We must unroll about three inches, and place the cartridge in the clip on the right side of the holder, as shown in figure 2. We now pass the black paper across the square opening at the back of the holder



1. Unlocking the camera

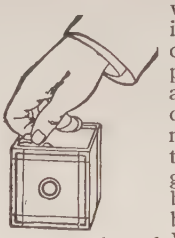


2. Inserting the film into the camera

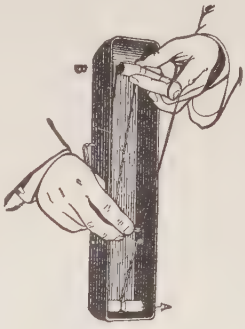


3. Fixing the black paper in position

and in front of the pasteboard flap. Taking up the empty reel, we then pass the end of the black paper through the slit, as shown in figure 3, seeing that the paper winds perfectly straight and true. We should wind it once or twice, and then again place the spool in the clip. If we like, we may insert the key and turn it once to the left, making the black paper draw tightly by bearing lightly upon the spools with the fingers. There are one or two important things we must bear in mind. The top of the full spool must come at the top of the holder. We can tell the top of the spool because it is marked on the end, and the top of the roll-holder contains the opening through which the key is inserted in the reel. Unless we see that this is correct, the film will be totally spoiled through coming on the wrong side of the black paper when it is unwound. Another thing we should remember is that if we unroll too much of the black paper before the camera is tightly closed, the film will be uncovered, and thus exposed to the light, which will ruin it.

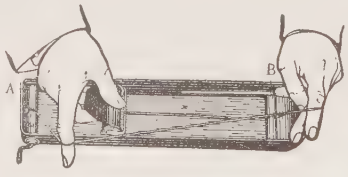


4. Camera charged



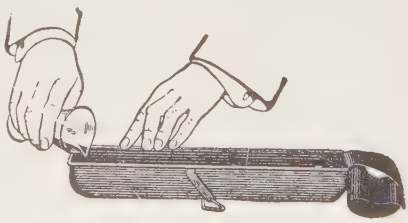
5. Arranging the cord round the rollers of developing box

We can now proceed to close the camera by reversing the operations that were necessary to open it. When we put back the holder, we must make sure that the slotted end of the winding reel comes opposite the key-hole in the outside box. All that now remains for us to do is to insert the key and fix it in position by turning the catches to the left, and then to turn the key to the left, as in figure 4, until the number 1 appears at the little red window in the back of the camera. It is now quite ready for us to take photographs.



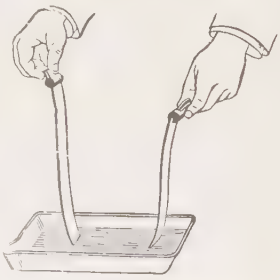
6. How to hold the cord

7. Unwinding the black paper



8. Pouring in the developer

The film is sensitive to white light, and the only way white light can now get at the film is through the lens in front of the camera. This lens has behind it a spring shutter which is always closed. By pressing a lever on the top of the camera this shutter flashes open for a very, very short time. It is during the short time the shutter is open that the picture is imprinted upon the film. A photograph taken in this rapid manner is called an instantaneous photograph or snapshot.



9. How to develop the film

A camera does not see a picture in colours as we do, but it sees everything in black and white, or masses of light and shade. It is the light shining upon things and creating shadows that makes the photograph for us. We should never attempt to take snapshots unless the day be bright and sunny, and we must never let the sun shine directly upon the front of the camera if we wish to get a good picture. We get a much better picture when the sun is shining behind us slightly to the left or right. When taking a photograph, we select a scene by the aid of the view-finder, and hold the camera at the sides with all our fingers underneath and our thumbs on top, our right thumb resting against the lever that works the shutter. We must hold it level and steady, and see that the lever at the left-hand side is pushed right in as far as it will go, otherwise we shall not get a good photograph. As soon as the lever clicks, the picture is taken, and we must wind the key to the left until the number 2 appears in the little window at the back. Should we forget to wind the key, we shall spoil the first picture by taking another on the top of it. In taking a portrait of a friend we must make a time exposure. To do this we pull out the lever at the left-hand side of the Brownie and rest the camera on a table. Remembering that the camera only sees the lights and shadows, we must place our friend partly facing the light. If we happened to put our friend facing the full glare of the sunlight, we should not get a nice picture at all, because the light would be much too strong, and there would be practically no shadows. In a very bright room, containing two windows, we should make an exposure of two or three seconds on a sunshiny day; on cloudy days we may have to expose the film for thirty seconds; while in very dark rooms with dark wallpaper we may have to give an exposure of two and a half minutes on a dull, cloudy day. With a little practice we shall very quickly learn what length of time is required in different lights.

Developing the films requires much care. In the developing we may make or mar a picture. All developing must be done in a dark-room into which not a single ray of daylight can enter, and we must develop in the very dull light of a ruby lamp, because red rays of light do not, as a rule, affect the films. We shall want in our dark-room a deep china dish or bowl, a pail to take the waste water and developer, and a large bowl of cold water. We must be sure and have cold water, for if the water is warm it will melt the thin layer of sensitised gelatine on the films.

Absolute cleanliness is essential in the dark-room. We must see that all our developing dishes are scrupulously clean, and we must do our best to avoid splashing the water about. If any tiny pieces of grit get into the dishes, they will, in all probability, scratch the soft gelatine, and when the picture has developed we shall find a big mark right across it. Such an accident, when it happens, is bound to occur to a picture we particularly want.

To prepare the developer, we dissolve the contents of one developing powder in four ounces of water, and pour it in a developing dish. Then we dissolve one ounce of acid hypo in eight ounces of water, and pour it in the hypo tray ; this is the fixing bath. The other dish we fill with clean cold water.

Unrolling the film and taking off the strip of black paper without touching the face of the film, we pass it through the dish of clean cold water several times, keeping the film side downwards and holding it as in figure 9. When the film is thoroughly wet, we should place it in a large bowl of cold water, taking care that the film is not cracked or folded.

After a time, we proceed to pass the film through the developer in the same way that we wetted the strip. We must keep the film continually on the move, for if we stop moving it we shall stain and spoil it. In about one minute the image will begin to appear, and the film should be fully developed in from five to ten minutes. Then we go through the same process in the fixing bath. When the strip of film loses its milky appearance and becomes transparent, it is fixed. It now has to be washed very thoroughly in running water for about an hour, and then dried. When dry, we can cut the strip up into its proper sections and print our pictures. After being developed, the strip of film consists of a series of negatives, so called because all the black parts in the subjects photographed are white and the white parts are black when held up to the light. From the negatives we print the positives, which are the photographs that we all know.

There are many ways of printing, either in sunlight or gaslight. The negative must be placed in the printing frame with the dull side against the sensitised side of the printing paper.

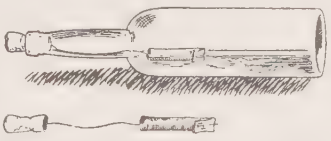
If we use a self-toning paper, we simply have to drop the print into an ordinary fixing bath, and the photograph becomes toned and fixed at the same time. If we use the ordinary printing-out paper, we must tone it first and then fix it, after which it must be well washed and dried. Whatever paper we use for printing, we must carry out the instructions on the wrapper if we wish to get good results. With the mounting of the print we complete our work.

We may, if we prefer it, cut the film up into the proper number of pieces and develop each picture singly, but we must take care not to cut a picture in half. It is also possible to develop in the daylight by using a special Brownie developing box which does away with the otherwise necessary dark-room. By a very simple and ingenious arrangement, we are able to fix the film in the box in such a way that when the developer has been correctly poured in, as shown in figure 8, and the box has been closed, we can easily unroll the film by just turning a little handle. Figure 5 shows us how we must fix the cord in the developing box ; in figure 6 we see the cord attached to the roll of film ; while figure 7 shows us how to start unrolling the black paper from the film by passing the end of the paper underneath the roller on the left marked A.

A LITTLE TOY CANNON

The idea of loading a cannon with a seidlitz powder seems funny. Of course, our cannon will not be a real cannon ; it will be an ordinary pint or quart bottle. And we need not be afraid that we shall shoot ourselves or anybody else when we discharge it.

First, we take a bottle and put sufficient water into it so that when it is turned on its side none of the water will run out. This means that the bottle will be about one-third full. Into the bottle we put the powder that we shall find in the blue paper of a seidlitz powder, and we shake the bottle so that the powder will dissolve properly. Now we take a piece of paper, and, by rolling it round a lead pencil, make a paper tube from two to three inches long. We close the tube at one end, either by plugging it with a cork, with another piece of paper, or simply by folding the end over a little and fastening it with a small pin.



The seidlitz-powder cannon. The lower picture shows how the powder is fixed.

Then we take a cork that fits the bottle tightly, and, having tied a thread to the upper, or open, end of the paper tube, we fix the other end of the thread into the under side of the cork by using a pin. The thread should be of such a length that when the cork is put into the bottle, the tube will be about half-way down the bottle inside and just floating above the surface of the water in the bottle.

We now put into the paper tube the contents of the white paper in a seidlitz powder, and put the paper tube into the bottle, and then push the cork in tightly. All that we need to do now is to lay the bottle on its side on a table or chair. Presently our cannon will fire itself. As the water gets into the tube with its powder, it will fizz, and the force of this will send out the cork with a bang. The experiment is perfectly safe, but we must not stand in front of the bottle.

MAKING A COLLECTION OF ROCKS

We read all about the crust of the earth upon which we live on page 2887 of this book and on the pages that follow, and it will be a recreation that is both entertaining and instructive to form a collection of rocks and fossils. These will provide literally "sermons in stones," for every stone, dumb as it may seem, has a story to tell and a lesson to teach.

WHAT THE COLLECTION SHOULD CONTAIN

In making a collection of stones and rocks, we should aim to have every layer of the earth's crust represented. There should be specimens of the rocks formed by the action of fire, rocks formed of material deposited by water, pieces of those parts of the earth's crust formed by layers of vegetable matter, like the coal measures; and then we should have as many varieties as possible of fossils—that is, creatures that lived in a bygone age and have been turned into stone and thus preserved. Then, wherever we keep our collection of stones, we should always try to keep them in their right order—that is, according to the age when formed, or, what usually means the same thing, the depth at which they were found.

WHERE TO OBTAIN SPECIMENS

Specimens of many rocks are not difficult to obtain. We may find many specimens lying about on the seashore when we are away on a holiday—and it is astonishing what a variety of rocks may be got together in this way in the course of a few years—granites, limestones, sandstones, serpentine, quartz, madrepore, or coral, and so on.

Then we may sometimes find a specimen we are wanting in one of the roads of our cities or towns. Some years ago a boy who belonged to a geology class saw in a macadamised road that had recently been relaid with stones, though not yet gone over with the steam-roller, a piece of interesting rock called mica-schist. Stooping to pick this up, he found by its side another rock called gneiss, and then a fossil, half embedded in rock. This aroused his interest, and he picked up another and another until all his pockets were full.

Having shown his fellow-students the fine geological collection that he had secured in this unusual and unexpected way, it was not long before thirty or forty boys were wandering up and down the road picking up stones here and there, and filling their pockets. This went on for several days, until at last a policeman was told off to guard the road. Probably it was the first time that the guardian of the law had had to protect the road itself from being carried away. Of course, the wholesale removal of a macadamised road is not recommended, but by keeping our eyes open, even in the streets of our towns, we may often come across a specimen well worth adding to our collection.

TOOLS FOR OBTAINING MINERALS

Naturally, the specimens that teach us most, and that will in after years be of most interest to us, are those that we actually chip out of their rocky bed in some quarry or cutting. For this purpose we need quite inexpensive tools—simply a good steel hammer and a strong chisel of good quality. In selecting the hammer, we should see that the head is broad and thick at one end, and the other end should be wedge-shaped. A hammer of this kind is quite indispensable to the geologist, and it will be found to serve its purpose well.

When we secure a specimen, we should chip it into a convenient size and shape and wrap it up in a piece of paper, upon which we should write the place in which it was found.

There are many places in which we may chip out our own specimens—railway-cuttings, road-cuttings, quarries, mining works, brick-pits, and so on; and the workmen at these places will be found to be generally very civil, and willing to assist us in securing specimens. If we are living or staying near any of these works, we can often induce a labourer to save us anything interesting that he comes across in the way of fossils, and we can learn from the men where fossils are most likely to be found in the district.

HOW TO KEEP THE SPECIMENS

On arriving home after an expedition, we should sort out our newly obtained specimens, write a neat little label for each, bearing the name of the place where it was found, the name of the rock, and, if we know it, the geological name of the formation, or the layer of rocks, from which it came, and paste each label upon the specimen to which it belongs.

To serve as cases for our rocks and fossils, if we have no proper cabinet at home, we can obtain flat wooden boxes for a few cents from the grocer or druggist or make flat trays with rough compartments to hold the specimens, which as a rule should not be larger than a big walnut.

No region in the world will afford a more varied collection of minerals or of fossils than North America, especially if the collector happens to live among the mountainous parts in New England, or along the Alleghanies; the whole country is a sort of geological museum, for the strata or layers of rock in the crust of the earth have been so broken and heaved, and then so ground down on the crests of the ridges, that the edges of almost the whole series of strata are sometimes exposed to view. This is still more true of the Rocky Mountain region, where thick masses of strata stand almost upright against the mountains which have been thrust up through them like wedges. Then, too, the rivers have cut deep trenches through the strata in some places, so that you can see just how they lie, and of what they are composed.

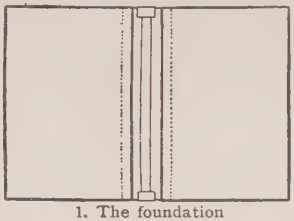
But it is also possible to collect many varieties of minerals and rocks even in the prairie country, by studying the pebbles and boulders which have been left there by the ice of the Glacial Period—a matter you will need and want to read about the moment you become interested in your subject.

HOW TO MAKE A DAINTY BLOTTER

A DURABLE and neat blotter which will hold notepaper and envelopes, and has a cover that can be taken off, washed, and put on again, is a useful thing to possess. The one described here is easy to make, and quite inexpensive.

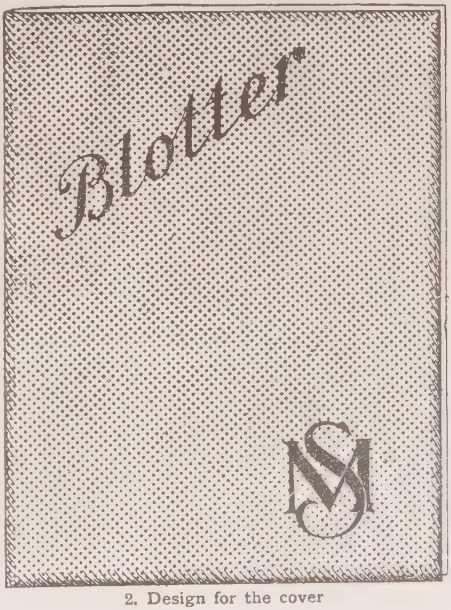
The materials required are two pieces of fairly stiff cardboard to form the two halves of the cover, a strip of calico to bind them together, some crash or coloured linen to cover the cardboard, a fine cord to sew round the edge of the cover, and a skein of embroidery floss or washing filoselle, costing 5c., for working initials or a pretty design on the cover.

A crash material, thirty-six inches wide and costing 25c. a yard, is frequently used for making blotters, because it is substantial, washes well, and, being of a canvas texture, may be readily embroidered. A suitable cotton cord costs very little, and a silk one can be got at 5c. a yard.



1. The foundation

The blotter can, of course, be made any size we prefer. For a large one measuring twelve inches by nine, half a yard of crash would be ample. The two cards—a good white cardboard is best—should be cut quite within these measurements, and exactly the same size, with smooth, neat edges. The strip of calico should be one and a quarter inches wide and longer than the card covers. These are placed side by side face downwards, about three-eighths of an inch apart, and the strip of calico is then stuck on the adjoining edges with liquid glue or a strong gum. We take care not to let the pieces of card touch, for if they do so the blotter will not open and shut easily. The ends of the calico are doubled over and stuck on neatly, as we can see in the first picture.



2. Design for the cover

While the card foundation is put aside to dry, we can set about cutting out the material for the cover.

If the material permits, the outside and the two pockets for the inside may be cut all in one long strip of thirty-six inches, just the width of the crash material, eighteen inches forming the back and front, and nine inches each for the inner pockets. The picture shows how the pockets inside are made. A broad hem prevents their openings from fraying, and their sides are run up on the wrong side. Before running them up, it is well to test the fit of the cardboard foundation which is to be slipped into them. And if we intend to embroider the front cover in any way, now is the time to do it, before the pockets are sewn.

Picture 2 shows a design for the cover outlined in deep pink embroidery floss. If we cannot draw the monogram, we can buy little model card letters at two cents each and work these on to the material with satin stitch. A pattern can be transferred in the way described on page 1507.

Having made the pockets, we next stitch the cord round the edge of the cover, choosing for its colour a pretty pink or perhaps a blue to match the embroidery on the outside. Before placing the card foundation in the cover, we cut out three sheets of blotting-paper, fold them to the size of the blotter, and stitch them on to the calico strip in the way that pages of an exercise-book are stitched on to the cover.

Now we can slip the two cards into the two pockets of the cover, and our blotter is ready for use. If we are thinking of giving our blotter as a present, we could, of course, make it look daintier by working a more elaborate design, or, better still, quite charming covers could be made of brocade or thick corded old rose or green silk, although this works out a little more expensive.

Should there be enough material left, a good idea would be to make a similar cover for a telephone book or a time-table. The paper covers are slipped into the pockets, and a fine cord is passed round the back of the cover and half-way through the book to keep it securely in the cover. A suitable design for this would be a railway signal-post and arm bearing the title of the book, or we might have the name Telephone Directory worked in a contrasting colour up the back of the cover, or slantwise on the front.

The best plan is either to write the letters ourselves in pencil, or get someone who writes a nice flowing hand to do so, and then sew over the pencil. If we are good at printing, we may prefer to print the letters, or we may even use a stencil pattern.

A CHILDREN'S ENCYCLOPÆDIA PARTY

WITH A PROGRAMME OF GARDEN PLAY MADE UP FROM THIS BOOK

It sometimes happens that, when a boy or girl asks permission to give a party, the answer is: "Certainly—if you can manage it yourself, and won't expect me to amuse your guests." With a little forethought and arrangement any boy can give a most successful party if—and this is a most important thing to remember—if he carefully plans out every minute of the afternoon, and leaves nothing to chance. In the suggestion given below, references will be found to the particular page in THE BOOK OF KNOWLEDGE on which the game or trick is fully described. This party lasts for about four hours.

WHAT TO DO AND HOW TO DO IT: A LITTLE PROGRAMME OF EVENTS

TIME	GAME
3.0	STICKERCHIEF
3.20	MEASURING THE HEIGHT OF A TREE
3.30	WHAT CAN BE MADE FROM POTATOES AND CUCUMBERS
4.0	A SACK RACE
4.20	TEA
5.0	CONJURING TRICKS
	A BALL THAT ANSWERS QUESTIONS
	MAGIC SCISSORS
	CUTTING THE MAGIC STRING
	THE MAGICIAN'S JACKET
5.30	HOW MARY GOT THE EGGS
	The problem can be set on the lawn with a rug and planks
6.0	SEMAPHORING
6.30	TUG-OF-WAR
6.45	HOT-AIR BALLOONING

This gives a very good afternoon's entertainment, and will sustain the merriment right from the beginning to the end. Other games for a children's garden party will be found on page 4242. Inexpensive prizes of sweets or toys may be given to the winners.

THE WAY TO IDENTIFY A SELECTED CARD

To identify a selected card without ever touching the pack of cards is sure to mystify and impress an audience.

We take a pack of cards and ask one of the audience to hold it. Then we ask another member of the audience to select a card from anywhere in the pack, to look at it so that he can recognise it again, and to show it to the audience but not to us. Then we ask the friend who selected the card to place it at the bottom of the pack. The holder of the entire pack is then requested to lay the pack on the table face downwards.

We must invite a third friend to assist us. His part of the performance is to cut the cards, that is to say, to lift any number from the top of the pack and put them at the bottom of the pack. Finally, we ask yet another member of the audience to lay the cards face upwards on the table one by one, beginning at the top and going right through the pack. When he has done this we are able to tell the audience which was the card selected.

This looks very difficult, but it is really very simple. Before handing over the pack at the beginning, we look to see what card is at the bottom of the pack. When the cards are finally laid on the table one by one, the selected card always follows immediately after the card which we saw at the bottom.

HOW DID THE FARMER ENLARGE THE FOLD?

A FARMER had fifty hurdles, and with these he made a sheep-fold that would hold exactly a hundred sheep. Later on, as he had a good deal of fine pasture land, he decided to increase the number of his sheep, and so he went to market to buy some more of these animals. Prices were low, and, although he had intended to buy only about fifty more sheep, he changed his mind and bought a hundred. The result was that, having now double the number of sheep that he possessed originally, he would require double the accommodation in his fold. A friend who had driven to the market with him remembered this, and mentioned the matter.

"Oh," said he, "I had forgotten that; but it is easily put right. I must buy two more hurdles and then I shall have sufficient room."

"Only two more hurdles to give you double the space in your fold? You have made a mistake," said the friend.

But the farmer was quite sure he was right, and he bought only two hurdles, although his friend said that he would require more.

The next day the farmer met his friend.

"Well, I have doubled the accommodation of my sheep-fold, and found the two extra hurdles quite sufficient," said he.

The friend seemed very doubtful, so the farmer took him to the field where the fold was, and in a moment the friend saw that the farmer was right. How did he do so much with only two hurdles? The answer to this little problem will be found on page 4354.

THE RIGHT WAY TO MEND THINGS

THERE are many things in use almost every day that get broken, and are then laid aside as useless, although to repair such broken things is really an easy task, if only we knew how to set about it. A few hints will be useful to us, and enable us to mend our broken toys and books and other things and make them almost as smart in appearance as when they were new.

BROKEN TOYS

Accidents happen to toys in spite of the care taken of them; but it is a pity to put them away as useless when they can be mended and made almost as good as new. Glue, tape, string, paint, nails, and paper are some of the things we shall require.

Crumpled tin soldiers can be straightened with pincers and freshened with coats of paint; bent tin trains hammered and pressed straight; broken arms of a windmill, loose wheels of carts, legs of furniture belonging to the dolls' house, and numbers of wooden articles mended with glue. If we are at all handy, we shall have no difficulty in soldering substantial metal playthings. Any of these toys when repaired would be welcomed with open arms by the children in hospitals.

TORN MUSIC

Sheets of printed music easily tear round the edges, and a slit once started is apt to end in a page torn in halves. A good way to prevent this, and also to strengthen the margin of the sheet, is to cut a piece of very thin paper the required length and width and paste it on. If a tear occurs across the printed part, we should dip a strip of tissue-paper in white of egg and use that, as the music can be read through it. A reel of transparent adhesive paper, which answers the same purpose, may be had for a few cents. A binding of narrow ribbon will greatly strengthen the back of the damaged music.

A WORN BOOK

The covers of books that have been roughly treated or imperfectly bound often tear away, half the cover usually becoming detached first. The part torn away can be mended by gumming it up the back, strengthening it with linen, and sticking the loosened half of the cover to the first page; but, if the binding be very stiff, thin glue is a better adhesive.

A loose page can be secured by folding a strip of the adhesive paper and sticking one half of it to the loose page and the other half to the next page in the book. This can be repeated on the other side of the page.

A BROKEN SPADE AND BASEBALL BAT

When the stick portion of a wooden spade breaks in two, we should get a thin piece of wood, whalebone, or steel, and, placing the broken ends together, bind it along them like a splint, with a piece of twine wound tightly and evenly round and round. A second splint adds strength, but looks clumsy. We can tuck the ends of twine in with a penknife. If the stick breaks off at the blade, the spade cannot be mended; but, if the blade is made of iron, we may burn the wood out of the socket, point the stick, insert it, and fasten it with a nail or screw. A split bat can be mended by binding it tightly with good twine, that should be beeswaxed as it is put on. We must tuck the ends of the twine in very carefully to prevent it from working loose.

TORN BATTLEDORE & BROKEN DRUM

If the parchment of these toys get punctured and torn, we must remove all the torn part, get a piece of parchment paper —good typing paper will do—cut it to shape, soak it in white of egg, and paste it over the frame of the battledore or drum.

A PUNCTURED CYCLE TIRE

We must partly remove the outer cover of the pneumatic tire and take out the inner tube. After pumping a little air into the tube, we should listen to locate the puncture. If we cannot find it in this way, we may feel along the surface to discover the escaping air. If this test fails, we must put the tube in a pail of water, when bubbles will rise from the puncture.

We rub the tube with sandpaper about half an inch round the hole, apply a little rubber solution to the place and also to the india-rubber patch to go over the hole. When nearly dry, we stick the patch on, pressing the edges down firmly all round. Then we rub it over with ordinary French chalk and carefully replace the inner tube in position.

A DOLL'S BROKEN HEAD

If the china head of a doll breaks off at the neck, it can be stuck on again with seccotine or glue. Thin glue is suitable for china, wax, composition, or wood, and it must be coated along the broken edges. Doll's hair can be stuck on with the same adhesive substance.

BROKEN CHINA AND GLASS

Little ornaments which decorate the mantelpiece sometimes fall and get broken or chipped. Unless they are very badly broken, it is generally worth while mending them, and mending them is often easy.

They can be mended with thin glue, which can be squeezed out along the broken edge of the china or glass, or applied to it with a camel-hair brush. We must place the broken pieces together, and hold them so for a minute or two. The drops which ooze from the join must be wiped off at once with a rag, for thin glue dries very quickly indeed, and after it has dried it is very difficult to get it off.

BROKEN UMBRELLAS

If the handle of our umbrella breaks, we may be able to repair it with glue. If this fails, it must be replaced by a new handle. A fresh elastic band and button, or tassel, which may be bought quite cheaply, can be sewn on at home. A slit in the cover may be carefully darned and strengthened by a patch of silk on the inside, put on, of course, with the umbrella half closed. It is sometimes possible to straighten a bent tube, but in the case of a broken stick or broken ribs we must take the umbrella to an umbrella repairer.

AN EASILY-MADE STENCIL PLATE

If we have a design or pattern which we should like to transfer to a book or sheet of paper and use the same pattern over and over again, we can do so by making a stencil plate in the following way, which, for outline designs, is very much simpler than the more elaborate stencil plates described on page 1921.

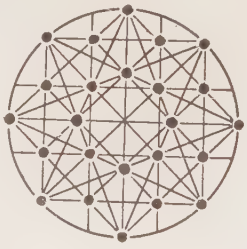
We must lay the drawing we wish to copy upon a sheet of thick paper, such as cartridge paper, and with drawing-pins fasten the two sheets together upon a table or drawing-board. Then with a pin or needle we must prick all over the outline of the design or picture, being very careful that we make the pinholes neat and clean and at fairly even intervals all over the lines.

It is essential that the paper and the picture from which we are making a stencil plate should be pinned down firmly to the drawing-board, and not allowed to move upon one another in the slightest degree while we are pricking the holes, or the outline will not be an exact copy of the picture we are tracing. Whether it is a flower, or a bird, or an ornamental design, it will, if the paper is allowed to slide about ever so little on the picture, be badly out of proportion. Now let us remove the drawing-pins and take away the upper picture. We shall find that the clean sheet of paper has the outline of the pattern transferred to it in a series of little holes. To multiply the pattern in a book or upon other paper we have only to pin this perforated sheet down and dust it over with powdered charcoal, a bag of which may be bought at any paint shop for a few cents. The charcoal should be put in a muslin bag and be shaken over the stencil, great care, of course, being taken that the stencil is properly fastened down.

The powdered charcoal will penetrate through the holes in the upper paper and the design will be transferred to the paper or book below. Then we can remove the stencil and ink in the design, or, if we so desire, colour it with paint or crayons. The stencil plate can, of course, be used a great number of times; in fact, it will last for a very long time indeed if treated with ordinary care. If we find any difficulty in getting a piece of cartridge or other white paper that is stiff, we can, if we like, use a sheet of brown paper. This, if it is of a smooth nature, will do quite as well as the white, and, being tougher than ordinary white paper, will last very much longer.

THE ANSWER TO THE PUZZLE OF THE TREES

Although it had at first seemed to the gardener quite impossible that twenty-four trees could be planted in such a way as to make twenty-eight rows, with four trees in each, and these in a straight line, yet the gentleman about whom we read on page 4146 was soon able to show that this was no impossibility at all, but in fact quite an easy matter. He drew a plan which showed exactly how the trees might be placed so as to fulfil the conditions that he had laid down, and this plan, which the gardener used and followed in carrying out his master's orders, is given here so that we may see the manner in which the trees were planted. It will be noticed, of course, that the rows do not stand one after another like a regiment of soldiers on parade, but that was not required, and, of course, with only twenty-four trees, it would be impossible to plant the rows in that way. But there are, nevertheless, twenty-eight rows, each containing four trees in a straight line, and the gentleman drew the lines of each row on his plan, for the guidance of his gardener, so that there might be no difficulty about the planting of the trees.



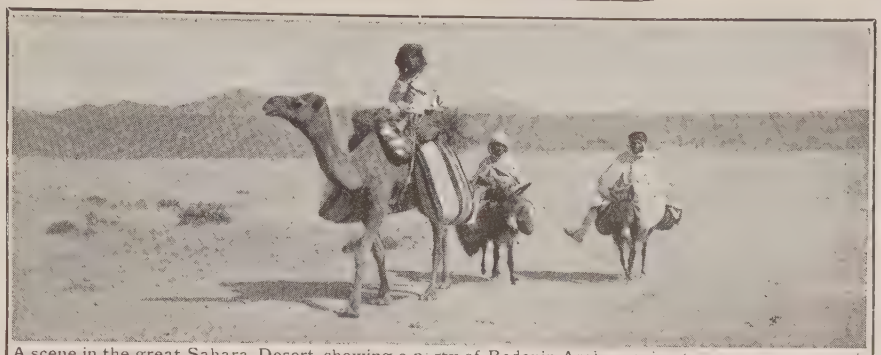
THE PROBLEM OF THE TRAVELLER'S DINNER

The Arabs about whom we read on page 4146 were very much astonished at the decision of the magistrate, and thought at first that he must have made a mistake. But he repeated his decision, and when the traveller who had possessed three loaves protested that it was against all justice that he, who had only two loaves fewer than his companion, should receive only one coin, while the other man received seven, the magistrate offered to explain why he had ordered the money to be divided in this way.

"One of you had five loaves," he said, "and the other had three, making eight loaves in all, and then, when the third traveller came up and joined, the eight loaves were divided equally between the three of you. Now suppose each loaf to be divided into three equal parts, there would, of course, be twenty-four parts, and as you divided equally between three of you, each received what was equal to eight of these parts. But one traveller originally had five loaves, or fifteen parts, and as he only consumed eight parts, he must have given seven to the foodless traveller. The other man had originally three loaves, or nine parts, and as he consumed eight, he only gave one part to the foodless traveller, therefore, as you can see, my decision is quite fair; the seven coins go to the man who gave seven parts, and the one coin to the man who gave one part."

Both the travellers had to agree that this was quite fair, although they had not seen it in that light before, and the man of the three loaves wished he had been wise enough to take the three pieces of money that his companion had first of all given to him.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4347



A scene in the great Sahara Desert, showing a party of Bedouin Arabs moving to a new encampment.

AFRICA OUTSIDE THE BRITISH EMPIRE

Egypt, Abyssinia, Morocco, Liberia, the Sahara, and the Possessions of the European Nations

CONTINUED FROM 4039

AFRICA is a huge, roughly-shaped, compact mass of land, three times as large as Europe, with a fifth of its surface covered with the largest desert in the world, and the rest of it rising from the surrounding seas, by great terrace steps, to high plateaus in the centre. Brimming rivers, with courses of from one to three thousand miles, plunge down the terrace steps to join the sea; mountains guard the coast nearly everywhere, the snowy peaks of those on the east side looking down on a most wonderful group of great lakes. Such is the face of Africa.

The burning sun, travelling overhead some part of the year in the greater part of Africa, looks down on millions of black and brown men—negroes and others—on millions of Arabs, on an ever-increasing number of white men from Europe, and on nearly all the beautiful and interesting animals with which we stock our Zoological Gardens. It is one of these animals, the elephant, with his valuable ivory tusks, that has helped to make history in Africa.

Now, the animals and the various tribes of negroes and other races, which are still in many cases heathen and uncivilised, have been there for an unknown length of time, roaming the splendid forests and living by the wonderful rivers and lakes, for ever absorbed in finding food and avoiding enemies. The valuable rubber trees in these forests have also helped in a very great measure to make history in Africa.

The Arabs, from the other side of the Red Sea, came at various times through the centuries, and found their way down the coasts, over desert and plain, over rivers and mountains, all over the land. Their coming brought woe to the black men.

The white men did not begin to come, except to the coasts within hail of Europe, till nearly the time of Columbus; and their coming also brought woe to the black men. The sorrow of Africa can be summed up in three words—slaves, ivory, rubber.

In the oldest maps, made by those who lived on the Mediterranean nearly 2,000 years ago, all that is shown of Africa is the north and north-western shores, and the narrow land of Egypt in the north-east corner near the Isthmus of Suez. This neck of land, joining Africa to Asia, was, in the past, the great highway of the nations from east to west. We read on another page, in the story of Beginnings, of the multitudes which passed over it; of the armies and embassies, and of the bridal and funeral processions. But neither the civilised old Egyptians nor the peoples of the northern

shores knew much of the great continent behind the strip on which they lived, for the great desert stood as a barrier in the way, and the ship of the desert, the long-enduring camel, was not launched on the ocean of sand till the much later times of the Romans.

THE BRAVE MARINERS WHO FIRST DREW THE MAP OF AFRICA

We have to pass over many centuries, to the days of Prince Henry the Navigator and his brave Portuguese, of whom we read on page 3354, before much change is seen on the map of Africa. One of the results of their daring efforts, of their courage and perseverance, was that the discovery and shape of the outer rim of the great continent was made known to the world, and Africa, as a whole, could be sketched on the maps, together with the names of the settlements made gradually along the coasts by the Arab traders and the seafaring nations of Europe.

But the interior of the great Dark Continent—what of that? The Arabs had always tracked farther and farther inland in pursuit of their dreadful trade—kidnapping and selling human beings; and in time the white men followed their example and also engaged in the traffic. But for a long time little or nothing was known in Europe about the vast heart of Africa, and so the map-makers were driven to fill up the blank white space with drawings of fancy animals. Indeed, those of us who were at school only half a century ago found Africa a very easy map to draw and learn—there were so few names in the middle of it.

THE JOY OF THE MEN WHO DISCOVERED THE SECRETS OF DARKEST AFRICA

On page 141 we read how strong, brave, and good men have followed each other, exploring the unknown parts of Africa, some with the view of helping to destroy the slave trade and to teach the negroes, others to find out the sources of the rivers and to map out the country. Intense was their joy when the great lakes burst upon their astonished sight, and the snowy peaks came into view, and the thundering roar of mighty waterfalls on stupendous rivers deafened their ears as the boiling foam dashed high in the air. These were some of the secrets hidden so long in the heart of Africa. Of all the sorrowful ones that explorers have found, the saddest are the hard, beaten-down paths across Africa, trodden for centuries by the feet of gangs of miserable slaves, torn from their homes, which were often lake dwellings for safety. Sometimes they would carry ivory to the coast; but for none of them was there any return.

We can follow the light-bearers into the Dark Continent by reading their most interesting narratives, and by studying in the Ethnographical Gallery of the British Museum the specimens of the work of the numerous tribes they visited: these objects show their curious customs and manners and taste.

Many of the travellers are held in remembrance by the names of places on the map; and, standing by Livingstone's last resting-place in the nave of Westminster Abbey, or by Speke's monument in Kensington Gardens, we think of the chain of graves that mark the white man's progress across unknown Africa. Much of it, owing to the great heat and the swamps, and the insects that carry infection, is very unhealthy and trying, especially to Europeans.

HOW THE SLAVE TRADE IS DISAPPEARING AS AFRICA GETS BETTER KNOWN

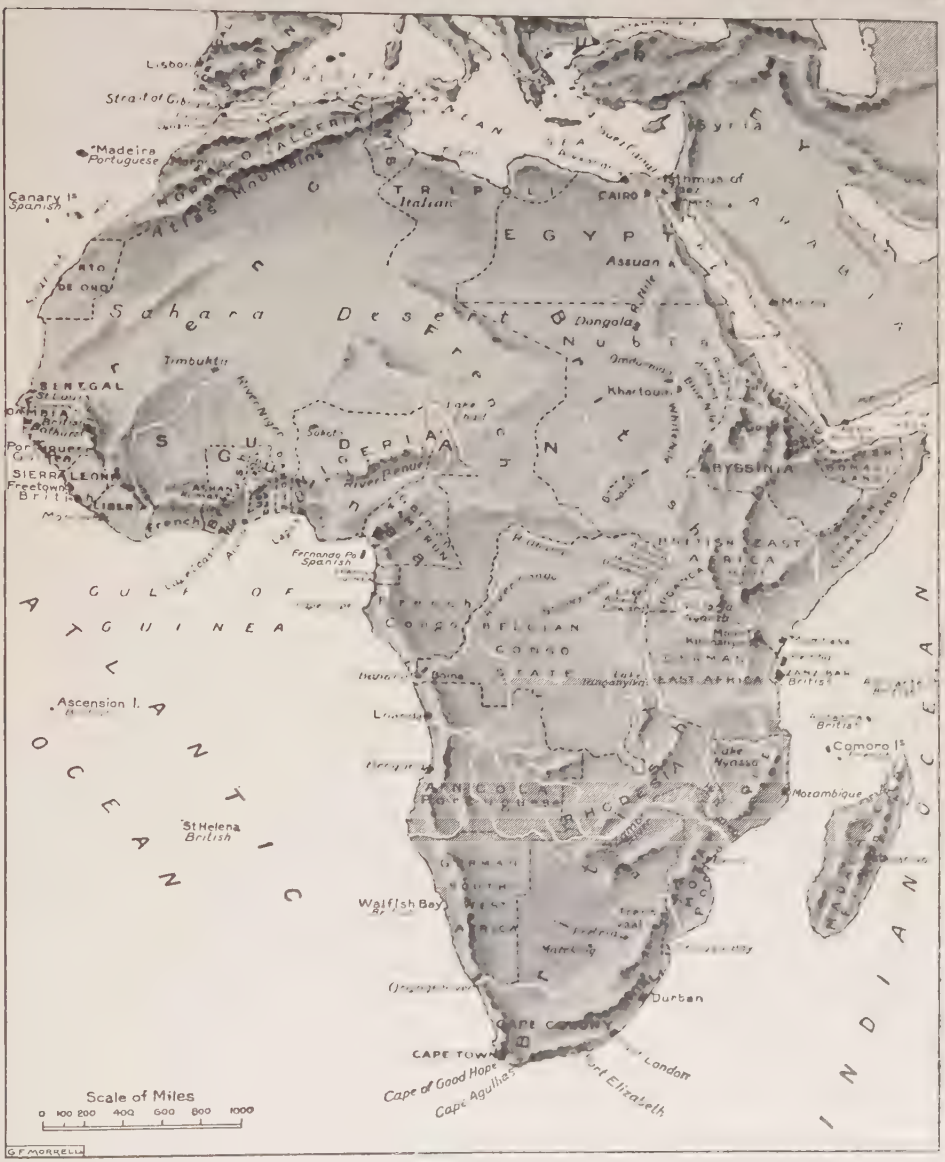
But the map is still filling up; the slave trade is gradually being suppressed; and serious attention is being called to the cruelties practised on the natives forced to collect rubber.

Let us now turn to the relief map on page 4253, and look more closely at the great continent, with the countries of the widely differing people that live upon it. It is not all new to us, for we know its shape by reading about the British Empire in Africa in that part of our book beginning on page 1765. Its southern tip points to the South Pole; its eastern horn points to India, and round the Gulf of Guinea it faces westwards.

We read, too, in the stories of France and Germany, of their vast possessions in Africa, and may, perhaps, realise the great heat of the Red Sea as the pilgrims cross it on their way to Mecca, or the steamers pass by the short cut to India. As we look at the narrowness of the Strait of Gibraltar, we think again of the Moorish warriors pouring over the sea into Spain. We are probably familiar with the eastern end of the wide, far-reaching deserts

of the middle of the Old World, for we read about it in the story of Arabia, Syria, and Persia, on page 3874. Its western extension, separated from the eastern side only by the narrow Red Sea and the equally narrow fertile valley of there are oases, such as we see in Asia, where springs of precious water, with refreshing vegetation, make life possible.

The hills that rise from the sun-scorched Sahara are higher than any in Great Britain. The Atlas Mountains,



AFRICA, WITH THE NAMES OF THE EUROPEAN POWERS PRINTED ON THE LANDS THEY CONTROL

Egypt, stretches right across the wide part of Africa to the Atlantic. This is the immense desert of the Sahara, more than half the size of Europe. The greater part is rainless, sandy, rocky, or with poor, grassy lands; here and

opposite Spain on its northern boundaries, are as high as the Swiss mountains, with fine valleys and lovely scenery.

The Abyssinian highlands, south-west of the Red Sea, consist of high and rugged mountains rising from a series

of tablelands, with deep, dark ravines between. South of the Abyssinian heights rise the twin giants of Africa —Kilimanjaro and Kenia—both close to the Equator, and between the great lake, Victoria Nyanza, which is as large as Scotland, and the sea. Both are taller than Mont Blanc by some thousands of feet.

The land in this mountainous region sinks to the sea in particularly steep terraces. The hilly borders of the high inland tablelands sometimes come close down to the sea; sometimes there is a varying width of coastal plain, generally very unhealthy for Europeans. Both act as guards that defend the country.

And the rivers of Africa, leaping and foaming down the terraces and gorges of hills that edge the plateaus, are not open gates for trade and conquest like the Yang-tse-kiang, the Rhine, and the St. Lawrence, for in most cases through navigation, from the sea inland, is impossible. Still, when the difficulties of the rapids are overcome, explorers find the immense reaches of the navigable parts of the rivers the easiest way by which to open up the country.

THE NILE, THAT FLOWS IN EGYPT LIKE A MIGHTY THOUGHT THREADING A DREAM

There is at least one immense river to every side of Africa. On the north, draining to the Mediterranean for over 3,000 miles, is the Nile, one of the most interesting and wonderful rivers in the world, "flowing through Egypt like some grave, mighty thought threading a dream." The first cataract, or rapid, on the Nile is hundreds of miles from the sea.

Into the Indian Ocean on the east side pours the great Zambesi River, opposite the island of Madagascar. Navigation is very difficult near its mouth. Its tributary, the Shiré, drains Lake Nyassa, and is of great use in passing through the country. The magnificent Victoria Falls, high up on the Zambesi itself, can only be compared with Niagara. The great river suddenly dashes over a cliff about 330 feet high, with a deafening roar, while the spray is shot high in the air. Truly it is one of the wonders of the world!

From the high tableland beyond the group of great lakes rises the mighty Congo, nearly 3,000 miles long; it circles away to the western side of the continent to empty its immense volume of gathered waters into the Atlantic. The explorer Stanley marched for five months through unbroken forests in its basin, and his name is commemorated in the Stanley Falls. There are over 6,000 miles of navigable waterway in the Congo and its tributaries that are above the deep gorge through which it reaches the sea by many falls.

THE THREE GREAT RIVERS OF THE FUTURE THAT WATER THE HEART OF AFRICA

The Niger, with its tributary, the Benue, draining into the Gulf of Guinea, is also very important in opening up a way to some of the richest land in Africa. It touches the Sahara on the south, near Timbuktu, the central meeting-place of the caravan traffic.

The Zambesi, Congo, and Niger may be called rivers of the future, so vast are the resources to be opened up in their basins. The Nile has a great past as well as great prospects. For countless centuries it was worshipped as a god, so mysterious and wonderful are the blessings it brings to the country it has made. The mystery has disappeared since the sources of the Nile were discovered; and no longer are beautiful thanksgiving hymns sung to the Nile, nor offerings cast into its placid bosom; but it steadily goes on making and blessing Egypt. "Egypt is the gift of the Nile."

Now, Egypt is practically a long, narrow oasis in the great mid-world desert. In shape it has been compared to a lily with a bent stalk. The lily is the delta on the Mediterranean, and the stalk is the long course of the river, with the few miles of green and fertile land that lies upon either side.

HOW THE NILE COVERS EGYPT EVERY YEAR WITH A MANTLE OF FERTILE MUD

We might ask how the fertile soil, under which lies the desert sand and rock, got there. Every year through the centuries, except in black years of famine, the Nile at certain seasons has swollen and risen from its bed, flooding the lower country till it all looks like a sea of many islands, with the villages and farms standing out above the expanse of water. A mantle of delicate green is thrown over all a few months later, when the water has subsided and has left behind the layer of mud which makes Egypt so fertile. Three crops a

THE CITIES OF NORTHERN AFRICA

The city of Algiers is nearly a thousand years old, and is a wonderful meeting-place of Eastern and Western life. For centuries it was misgoverned by its Turkish deys, or rulers, but in 1830 the French took Algiers and have made it a fine city. Its great glory is a wide avenue with a magnificent terrace built by an Englishman.

Tangier, the chief seaport of Morocco, is a badly-built, dirty town, where the European ministers to Morocco have their homes. At one time it belonged to England.

Mazagan is another Moroccan seaport, which has a considerable trade in grain, almonds, wool, and oil. Here we see the market-place in the Jewish quarter.

Cairo, the capital of Egypt, is the largest town in Africa, and the modern city is built on the remains of four distinct towns. In the native quarter, with its narrow, winding streets, the foot passenger must keep a sharp look-out to avoid being trampled upon by camels and donkeys. Cairo is noted for its beautiful mosques.

year grow in the fields, enriched and refreshed by the waters of the Nile. It is impossible to sail or steam along the broad river-highway without being filled with wonder at the stupendous remains and ruins on its banks. They are the glory of Egypt, the works of the men who chanted hymns to the Nile-god thousands of years ago.

We can enjoy the grand buildings and enter into the old life of the country in another part of this book, so let us now take up the story of Egypt when the Egyptians were under the Romans.

When Britain was but an outlying, barbarous province of the great empire, Egypt, in its south-east corner of the Mediterranean, easy of access to almost every part of the Roman world, was one of the most civilised and important of its provinces. We have seen how distant Britain had to be abandoned when the empire grew weaker in the fifth century. Egypt remained under the Eastern, or Greek, Empire after the great division into East and West, and had its share of attacks and misfortunes with the rest of that long-dying Power.

How the Persians conquered Egypt, but were driven out

The Persians, early in the seventh century, held Egypt for ten years, but were forced by Heraclius to retire. We read of this gallant emperor on page 3152. In these centuries there were great difficulties about religion. When the Egyptians accepted the Christian faith with the rest of the empire, they tacked on all sorts of ideas and customs connected with their ancient faith.

There were endless persecutions and difficulties between those who thought one thing and those who thought another, and the feeling became very bitter among these different sects.

When the Mohammedan troops of the Caliph Omar, about whom we read in the story of South-west Asia, on page 3876, appeared before Alexandria, the great seaport of Egypt, there was no united front in Egypt against these followers of Islam, and they were able to carry everything before them.

And so Egypt passed under the sway of the caliphs and the Arab tribes, many of whom had long before made settlements round the east coast, and spread not only over Egypt and North Africa, but ever farther and farther inland. On the whole, the Egyptian Christians, or Copts, had a better time under the rule of the caliphs than they had had under the Greek Christian emperors; but the country was neither developed nor well governed in those luxurious days, and it was often divided by quarrels about religion. After a time began the struggles with the conquering Turks.

The wise Saladin, who did much for Egypt and encouraged learning

The great Saladin, at the end of the twelfth century, did much for Egypt with his wise government. He fortified Cairo, the capital, situated on the banks of the Nile, about 100 miles from the sea, and strengthened the country against invasion, put down rebellions, seized ports on the Red Sea, and sent expeditions in various directions. Saladin's brother and nephew carried on his efforts. The methods of storing the Nile's overflow and carrying it where needed were improved, and trade and learning were encouraged.

It was in these days that a famous cavalry corps called the Mamelukes was founded, developed from bodyguards and brigades of strong young Turkish slaves. They gradually rose in power till the strongest and cleverest of these troops were able to make themselves in turn sultans and masters of Egypt. The story of their power, which lasted nearly 300 years, reads like a romance. At first slaves, then trained soldiers, they became chiefs and sultans.

The rise and the fall of individuals among the Mamelukes was rapid; power was only maintained by the strength and length of the sword. Such wild feats of horsemanship at polo matches and archery; such dazzling processions; such luxury in costly palaces adorned with ivory, gold, and silver; such rich carpets and hangings and sumptuous feasts almost baffle description.

The splendid mosques that the Mameluke rulers built for Egypt

The Mameluke rulers were great builders, as many of the splendid mosques, especially that of the Sultan Hassan, and other buildings in Cairo, still testify. When the Ottoman sultans found their way to Constantinople, it was not long before they determined to conquer Egypt. In vain

THE DAILY LIFE OF THE PEOPLE OF CAIRO

Cairo has a large European population, but the picturesque part of the city is the native quarter. This is truly Oriental, and the wonderful lattice-work of the houses shows Saracen art at its best. The streets are thronged, and the fruit merchants do a good business.

The streets of Cairo are narrow and winding, and the buildings present an endless variety of style. A traveller in the native quarter might think himself in some fairyland of the "Arabian Nights." A familiar sight is the lemonade-seller vending his cordial.

An old Arab writer has said that "he who hath not seen Cairo hath not seen the world; its soil is gold; its Nile is a wonder; its houses are palaces; and its air is soft, its odour surpassing that of aloes-wood, and cheering the heart." Perhaps none of its people has done so much to beautify the native city as the craftsman who works in ivory and wood, and produces the beautiful lattice-work that is so famous. He uses his left foot as a third hand, and, because of his skill in the use of this foot, he is known in the city as the "three handed man."

The photographs on these pages are by Messrs. Underwood & Underwood and Messrs. Valentine.

were extra taxes levied in the doomed country, fortifications erected, and the army strengthened. The fatal battle was fought near Cairo in 1517; street by street the capital was stormed, and the massacre of its people was carried on day after day for a whole week.

HOW EGYPT BECAME A TURKISH PROVINCE AND LOST MUCH OF ITS WEALTH

So Egypt passed to another stage in its long history, and became a province of Turkey, but it remained practically under the rule of the Mamelukes, with a ruler, or pasha, sent from Constantinople. The province, like many others, was taxed to the uttermost, and became poorer not only from that cause, but also because much of its trade passed from Alexandria to Constantinople. It also lost, about this time, the large sums it had levied on all goods passing to and from India over the Isthmus of Suez, when Vasco da Gama found the sea-route to the East round the Cape of Good Hope.

More than 200 years passed by, during which the Mameluke beys, or governors, under a nominal Turkish chief, fought and struggled with each other, entertained lavishly, built and restored fine mosques, and encouraged Mohammedan learning and the arts, when suddenly, and most unexpectedly, the wave of upheaval set in motion in France by the Revolution reached the extreme end of the Mediterranean.

Napoleon, longing to overthrow British power in India, determined to master the East by attacking Egypt. He managed to get his fleet from Toulon to Alexandria, and to fight the famous battle of the Pyramids, before Nelson could come to the rescue. We know how the brilliant successes of General Kléber, after Napoleon had returned to Europe, dwindled into complete failure, and how in the end 24,000 French troops were taken back to France in English vessels. The English themselves left Egypt soon after.

THE CRUEL MOHAMMED ALI, WHO PUT AN END TO THE MAMELUKE RULE

After this a dreadful tyrant, named Mohammed Ali, arose in Egypt. An Albanian by birth, he made his way upwards by great ability, and became pasha. He pushed his conquests to Arabia and to the Sudan, seized all the landed estates in Egypt itself, and extorted money and service from the miserable peasants, or *fellahin*, some of whom are descendants of the old Egyptians. At last he managed to get 500 of the Mameluke beys into the citadel of Cairo, and massacred them all.

We perhaps know the miserable part he and his son played when the Greeks were striving for independence, and of how Mohammed Ali finally made a brilliant success against the Sultan of Turkey, till then nominally his master. But the result of his successes were speedily lost by the rebellion of the conquered against his cruelties and oppression.

The chief event of the reign of Said Pasha, who was Mohammed Ali's youngest son, was the granting permission to the French engineer, De Lesseps, to make the Suez Canal. This stupendous work, nearly 100 miles long, was carried out in thirteen years, making Africa an island instead of a peninsula; and the world's ships now steam through the canal on their way north and south, carrying much of the goods traffic and nearly all the passengers to the Far East.

THE PEACE AND PROSPERITY BROUGHT TO EGYPT BY GREAT BRITAIN

Egypt's trade had a period of prosperity in supplying cotton, which grows so well there, when the American Civil War cut off the crop grown in the United States; but the country's money affairs were so mismanaged that they gained little benefit. England, which was the sea Power most concerned in keeping the way open to India, managed to plant a very firm foot in Egypt. It is England which has helped to arrange the affairs of the Khedive, as the Egyptian ruler, subject in name to Turkey, is now called; and it is chiefly Englishmen who have developed the country and put it in order.

The events of late years have been full of interest and trouble. Mutiny and jealousy in the Army was put down after the battle of Tel-el-Kebir and the fall of Alexandria. Many English soldiers to-day are wearing the clasp of this battle, which took place in 1882. There have been endless difficulties in the part of the Sudan which lies in the basin of the Nile. Sudan means the land of the blacks. It stretches right across Africa south of the Sahara—a fertile, well-watered, and very hot belt of country, now divided among various Powers. For many years the Sudan, as far as

THE PEOPLE OF TROPICAL AFRICA

Uganda, which is now a British protectorate, is a country where the missionaries have done splendid work, and where the brave Bishop Hannington sealed his testimony with his blood. Here is a typical village market, and as we can see the natives are happy and prosperous, very different from some other African races.

This is a native village in Portuguese East Africa, which lies between the Indian Ocean and the British possessions in South Africa. The country is unhealthy.

Against our climate is contained from Portuguese East Africa, and here we see a rubber plantation near Beira. The rubber is a tree that comes from the trees.

Here are two children of the Congo country. The population of this district, which now belongs to Belgium, is about thirty millions and includes different races.

Here is a village on Prince's Island, in the mouth of the Congo River opposite Boma, the seat of the Government and the home of the Belgian Governor-General.

the great lakes, had been held by Egyptian governors, whose chief idea was to get money out of the people, whom they sorely oppressed, especially in the terrible trade of slave-raiding. General Gordon, whose pluck and energy in the suppression of the Taiping rebellion in China is known to the whole world, was appointed governor, and did good work for some years.

How General Gordon Waited for the Help that Came too Late

The Egyptian forces met with some terrible defeats while trying to grapple with the rebellion organised by the Mahdi—a Mohammedan prophet who led the people, risen against the tax-gatherers and slave-drivers who had devastated their country. At last Gordon was sent out again to see what could be done.

He was soon surrounded by the forces of the Mahdi at Khartoum, and nothing could exceed the courage and heroism of his defence, always waiting in hope for the relief from without which came too late. It is a grand and pathetic picture to bear in mind, of the white man standing unmoved, unarmed, in the presence of the yelling black mob rushing at him with their long spears.

For eleven years the Sudan was left, cut off from the world, in an awful state of desolation, in which the people were starving and dying; and then General Kitchener, with a carefully trained army, took Khartoum and gained a brilliant victory at Omdurman. Since then railways from Egypt have penetrated to Khartoum, and connected it with the Red Sea. And in memory of the hero who lost his life, Gordon College has been built, to help on the education of the people in this great district.

It is hoped that some day the Sudan will be as valuable as Egypt itself, if irrigated and planted with cotton and corn; but the possession of the country of the upper waters of the Nile is necessary to Egypt, so dependent is it on its great river to water the soil.

The Torrents of Rain that Carry the Mud of Abyssinia into Egypt

When the tributaries of the Blue Nile and Atbara were traced to the highlands of Abyssinia, the mystery of the rise of the Nile and its fertilising mud were solved. The torrents of tropical rain tear down the earth from the gorges and the cliffs, and the muddy water rushes down through Nubia over the chain of cataracts to the almost level course from Assuan to the sea. It is at Assuan that the great dam across the river has been made to regulate the supply of water. It means famine and bitter sorrow to the people of Egypt when the Nile rises too little or too much, for then the fine crops of cotton, corn, flax, sugar, and hemp fail, and there is famine in the land.

Abyssinia is an independent state that has had many passages at arms with European nations. The hardy mountaineers adopted Christianity in early times; they have now many curious customs and beliefs.

At Khartoum the Blue Nile joins the White Nile, the main stream from the British district of Uganda, where it drains the Victoria and Albert Nyanza —the word Nyanza means lake. Few countries can give more exciting adventures than Uganda and the district between it and the sea. The railway now connects it with Egypt and with Mombasa, the gate of British East Africa.

A Country where People See Lions and Giraffes from the Trains

Travellers speak of seeing lions, giraffes, and zebras from the carriage windows. Some of us would dread to get out at the stations! Former President Roosevelt spent months here shooting lions and hunting the huge hippopotamus and rhinoceros on the river-banks.

We read in the story of Spain, beginning on page 3353, how the Mohammedans swept along the northern states of Africa—often called the Barbary States, from the early inhabitants, the Berbers—on their way to turn the European Pillar of Hercules into the Rock of Tarik, or Gibraltar.

For some hundreds of years they remained in undisputed possession of the coast, and then Spain began to carry its arms across the sea against the hated Moslems. In the sixteenth century pirates established themselves in the harbours of the coast; and Charles V. made many efforts, only partly successful, to dislodge them. These pirates, or corsairs, were men of extraordinary daring, and by attacking merchant ships and wealthy towns they secured great riches for their booty. When their stronghold was at last taken, a whole roomful of money was found containing

heaps of coins of all countries, showing by their dates how widespread were the attacks of these fierce sea-robbers.

Many and grievous are the stories of the sufferings of their prisoners. They made slaves of them if large ransoms were not paid. Eventually the Turks were drawn into the almost endless contest, and succeeded in obtaining for a while the chief power in North Africa. Many European states paid large sums to buy freedom from the attacks of the corsairs, who carried on their evil ways till less than one hundred years ago.

THE KING OF PORTO NOVO, IN DAHOMEY, PRESIDING OVER A COUNCIL OF HIS MINISTERS

The United States refused to do this, and sent fleets against them; and, at last, with the help of the English, who stood too long aloof, and the Dutch, matters improved; but it was not till 1830 that the French finally took Algiers and destroyed for ever the nests of the pirates. They set the captives free, took the roomful of money, and founded, after many difficulties, the French empire in Africa, which, as we read on page 2400, is so flourishing, spreading, as it does, over the Central and Western Sudan, over the basin of the Niger, and along the western coast of the great continent. Morocco, the most westerly of the Barbary States, is independent, like Abyssinia; and in it live Moors, descendants of the Mohammedans who conquered it in the seventh century, the Berbers, and numbers of Jews and negroes. Affairs have long been unsettled in Morocco, and all Europe seems to be standing round offering to help set things straight. France tries to reform the Government and money affairs, with the consent of Great Britain and Spain. France and Spain are organising a large police force, and there is a Swiss Inspector-General.

Turkey in Africa, once very large, hardly exists at all, as Italy has taken Tripoli, Tunis is under French protection, and the Khedive of Egypt is practically independent of the Sultan.

If we look at the map on page 4253, or make a map of Africa, marking the chief divisions, and set in each division little flags of the countries who own them, we shall gain a good idea of what is meant by "the scramble

for Africa." Except in a few cases, as we have seen, the uncivilised black races and tribes have been unable to hold their country either against Arabs or white men. So when particulars began to be known about the vast interior, at a time when most European nations were desiring room to expand across the seas, they turned to "unoccupied" Africa, each seizing the parts that were most easy to annex. The flags make a gay fringe right round the coast of the great continent.

THE FLAGS OF THE NATIONS THAT FLY ALL ROUND THE AFRICAN COASTS

Let us start from Egypt, with its crescents and stars. Tripoli comes next, with the Italian flag; Tunis and Algeria must be pegged out with French flags, stretching far south beyond the mountains into the Sahara. Some day the French hope to push a railway across the desert to their possessions on the Niger. Independent Morocco has its own red flag, though that of Spain signals from Ceuta, the Southern Pillar of Hercules, to the Union Jack that flies on the rock of Gibraltar.

Spain also owns the Sahara coast from Morocco to Cape Blanco, where the enormous French West African possessions begin. The independent striped flag of Liberia, the state of freed slaves, waves on the coast of Guinea, surrounded by numbers of Portuguese, British, French, and German flags, all marking the various divisions now owned by their countries. Then, on the Congo, we have French flags again marking out the territory reaching up to Lake Chad, that curious lake, sometimes as large as New Jersey and sometimes a swamp.

THE CONGO STATE, THAT IS NOW UNDER THE RULE OF BELGIUM

The Congo State, now under the rule of the Belgians, has only enough room on the coast to plant its flag, though it expands large and square in the interior to Uganda and German East Africa. Angola is Portuguese, so is a long strip watered by the Zambesi on the east coast, opposite Madagascar, which from end to end is French. South of Angola comes the German flag again. The southern tip of the continent needs many British flags to mark out its involved boundaries far up into Rhodesia. Between Rhodesia and British East Africa is the large tract of German East Africa, with the three beautiful lakes of Nyassa, Tanganyika, and Victoria Nyanza on its borders. On these great lakes are busy steamers connecting with the growing railway lines. From Zanzibar, celebrated for its cloves, the caravans for the interior fit out; and many are the stirring adventures with slave-ships on this part of the coast. Italian flags wave on the horn of Africa, reaching up to the Gulf of Aden, where British Somaliland separates Italian Somaliland from the other Italian colony, which cuts off Abyssinia from the Red Sea.

Rhodesia is named after that far-seeing statesman, Cecil Rhodes, and one of his many great plans for Africa was to unite north and south by a railway from the Cape to Cairo, his object being to cut Africa through the centre and pick up trade along the route. He longed to see the spray of the Victoria Falls from railway carriages crossing the Zambesi, and to hear the whistle of the engine along the Congo-Zambesi watershed to Lake Tanganyika, and the steady breathing of the iron horse racing the Nile stream to Khartoum to join the line from the north.

THE DREAM OF A GREAT ENGLISHMAN THAT IS COMING TRUE

Besides this main trunk-line, his mind planned many junctions to link up other railways or waterways from the great central plateaus to ports on the east and west. Some of his great dream has come true. The railway from the south has crossed the falls, and plans are on foot to join the Congo basin with the Rhodesian railways and the traffic on the great lakes.

Enterprise like this strikes at the very root of the slave trade and the cruelties connected with the gathering of ivory and rubber; for rapid travel opens up dark places and draws together the great and varied interests of the huge continent. And it is this lighting up and linking up that alone will make it possible for Europeans to carry out the obligations they take upon themselves when they hoist their flags over vast numbers of uncivilised natives in Africa. The trade of this vast country on either side of the railway is in its infancy, but great prospects are foreshadowed.

The next story of Countries is on 4381.

A FAMOUS AMERICAN POEM

THIS poem made the name of the American poet, Edgar Allen Poe, famous throughout his own land and widely known throughout Europe and the English-speaking world. When we read "The Raven," we seem to feel the anguish of a strong and loving nature to whom a dear one has but lately been lost. But this is entirely a work of imagination, not of personal feeling. The poem was first suggested to its author by his reading some verses entitled "Isadore," in which the refrain was, "Thou art lost to me for ever, Isadore." "Isadore" was written by an American author, long since forgotten, to express the emotion he imagined one would feel at the loss of a loved one, not because he was really in sorrow. Thus Edgar Allen Poe's world-famous poem was suggested to him by a poem which was also purely an effort of imagination. The raven he introduced from having been impressed by Grip in "Barnaby Rudge," and sought thus to invest the strange bird with more dramatic and mysterious interest.

THE RAVEN

CONTINUED FROM 4212

ONCE upon a midnight dreary, while I pondered, weak and weary,
Over many a quaint and curious volume of forgotten lore—
While I nodded, nearly napping, suddenly there came a tapping,
As of someone gently rapping—rapping at my chamber door.
"'Tis some visitor," I muttered, "tapping at my chamber door—
Only this and nothing more."

Ah, distinctly I remember, it was in the bleak December,
And each separate dying ember wrought its ghost upon the floor.
Eagerly I wished the morrow—vainly I had sought to borrow
From my books surcease of sorrow—sorrow for the lost Lenore—
For the rare and radiant maiden whom the angels name Lenore—
Nameless here for evermore.

And the silken, sad, uncertain rustling of each purple curtain
Thrilled me—filled me with fantastic terrors never felt before;
So that now, to still the beating of my heart, I stood repeating,
"'Tis some visitor entreating entrance at my chamber door—
Some late visitor entreating entrance at my chamber door—
This it is and nothing more."

Presently my soul grew stronger; hesitating then no longer,
"Sir," said I, "or Madam, truly your forgiveness I implore;
But the fact is I was napping, and so gently you came rapping,
And so faintly you came tapping—tapping at my chamber door,
That I scarce was sure I heard you"—here I opened wide the door—
Darkness there and nothing more.

Deep into that darkness peering, long I stood there, wondering, fearing,
Doubting, dreaming dreams no mortal ever dared to dream before;
But the silence was unbroken, and the stillness gave no token,
And the only word there spoken was the whispered word, "Lenore!"
This I whispered, and an echo murmured back the word, "Lenore!"—
Merely this and nothing more.

Back into the chamber turning, all my soul within me burning,
Soon again I heard a tapping, somewhat louder than before.
"Surely," said I, "surely that is something at my window lattice;
Let me see, then, what thereat is, and this mystery explore—
Let my heart be still a moment, and this mystery explore—
'Tis the wind and nothing more."

Open here I flung the shutter, when, with many a flirt and flutter,
In there stepped a stately Raven of the saintly days of yore.
Not the least obeisance made he; not an instant stopped or stayed he;
But, with mien of lord or lady, perched above my chamber door—
Perched upon a bust of Pallas, just above my chamber door—
Perched and sat, and nothing more.

Then this ebony bird beguiling my sad fancy into smiling,
By the grave and stern decorum of the countenance it wore,
"Though thy crest be shorn and shaven, thou," I said, "art sure no craven,
Ghastly, grim, and ancient Raven, wandering from the Nightly shore—
Tell me what thy lordly name is on the Night's Plutonian shore!"
Quoth the Raven, "Nevermore."

Much I marvelled this ungainly fowl to hear
discourse so plainly,
Though its answer little meaning—little
relevancy bore ;
For we cannot help agreeing that no living
human being
Ever yet was blessed with seeing bird above
his chamber door—
Bird or beast upon the sculptured bust above
his chamber door,
With such name as " Nevermore."

But the Raven, sitting lonely on the placid
bust, spoke only
That one word, as if his soul in that one word
he did outpour.
Nothing further then he uttered ; not a
feather then he fluttered—
Till I scarcely more than muttered, " Other
friends have flown before—
On the morrow *he* will leave me, as my Hopes
have flown before."
Then the bird said, " Nevermore."

Startled at the stillness broken by reply so
aptly spoken,
" Doubtless," said I, " what it utters is its
only stock and store,
Taught from some unhappy master, whom
unmerciful Disaster
Followed fast and followed faster till his
songs one burden bore—
Till the dirges of his Hope that melancholy
burden bore
Of ' Never—nevermore.' "

But the Raven still beguiling all my sad soul
into smiling,
Straight I wheeled a cushioned seat in front
of bird and bust and door ;
Then, upon the velvet sinking, I betook
myself to linking
Fancy unto fancy, thinking what this
ominous bird of yore,
What this grim, ungainly, ghastly, gaunt, and
ominous bird of yore
Meant in croaking " Nevermore."

This I sat engaged in guessing, but no syllable
expressing
To the fowl whose fiery eyes now burned into
my bosom's core ;
This and more I sat divining, with my head
at ease reclining
On the cushion's velvet lining that the lamp-
light gloated o'er,
But whose velvet violet lining, with the lamp-
light gloating o'er,
She shall press, ah, nevermore !

Then methought the air grew denser, perfumed
from an unseen censer
Swung by Seraphim whose footfalls tinkled
on the tufted floor.
" Wretch," I cried, " thy God hath lent thee—
by these angels He hath sent thee
Respite—respite and nepenthe from thy
memories of Lenore !
Quaff, oh quaff this kind nepenthe, and forget
this lost Lenore ! "
Quoth the Raven, " Nevermore."

" Prophet ! " said I, " thing of evil !—prophet
still, if bird or devil !—
Whether Tempter sent, or whether tempest
tossed thee here ashore,
Desolate, yet all undaunted, on this desert
land enchanted—
On this home by Horror haunted—tell me
truly, I implore—
Is there—*is* there balm in Gilead ?—tell me—
tell me, I implore ! "
Quoth the Raven, " Nevermore."

" Prophet ! " said I, " thing of evil !—prophet
still, if bird or devil,
By that Heaven that bends above us—by
that God we both adore—
Tell this soul with sorrow laden if, within the
distant Aidenn,
It shall clasp a sainted maiden whom the
angels name Lenore—
Clasp a rare and radiant maiden whom the
angels name Lenore."
Quoth the Raven, " Nevermore."

" Be that word our sign of parting, bird or
fiend ! " I shrieked, upstarting—
" Get thee back into the tempest and the
Night's Plutonian shore !
Leave no black plume as a token of that lie
thy soul hath spoken !
Leave my loneliness unbroken !—quit the bust
above my door !
Take thy beak from out my heart, and take thy
form from off my door ! "
Quoth the Raven, " Nevermore."

And the Raven, never flitting, still is sitting—
still is sitting
On the pallid bust of Pallas, just above my
chamber door ;
And his eyes have all the seeming of a Demon's
that is dreaming,
And the lamp-light o'er him streaming throws
his shadow on the floor ;
And my soul from out that shadow that lies
floating on the floor
Shall be lifted—nevermore !

THE HOUSEKEEPER

This quaintly humorous description of the snail was written by Charles Lamb, and it is in simple verses such as these that we can detect the kindly, gentle feeling of the poet, and his sympathy with the lowliest creatures of God's creation.

The frugal snail, with forecast of repose,
Carries his house with him where'er he
goes ;
Peeps out—and if there comes a shower of
rain,
Retreats to his small domicile again.
Touch but a tip of him, a horn—'tis well—
He curls up in his sanctuary shell.
He's his own landlord, his own tenant ;
stay
Long as he will, he dreads no quarter day.
Himself he boards and lodges ; both invites
And feasts himself ; sleeps with himself o'
nights.
He spares the upholsterer trouble to procure
Chattels ; himself is his own furniture,
And his sole riches. Wheresoe'er he roam,
Knock when you will—he's sure to be at
home.

AHAB MOHAMMED

There are many beautiful stories in the history of the Arabian rulers, and most poets have at some time or other turned to the rich legends of the East for inspiring themes. Few of those stories are more attractive than that of "Ahab Mohammed," which an American poet, named James Matthew Legaré, has set in this becoming dress of verse.

A PEASANT stood before a king, and said:
"My children starve, I come to thee for bread."
On cushions soft and silken, sat enthroned
The king, and looked on him that prayed and moaned,
Who cried again: "For bread I come to thee!"
For grief, like wine, the tongue will render free.
Then said the prince with simple truth:
"Behold
I sit on cushions silken-soft, of gold,
And wrought with skill the vessels which they bring
To fitly grace the banquet of a king.
But at my gate the Mede triumphant beats,
And die for food my people in the streets.
Yet no good father hears his child complain
And gives him stones for bread, for alms disdain.
Come, thou and I will sup together—come!"
The wondering courtiers saw—saw and were dumb:
Then followed with their eyes where Ahab led
With grace the humble guest, amazed, to share his bread.
Him half-abashed the royal host withdrew
Into a room, the curtained doorway through.
Silent behind the folds of purple closed,
In marble life the statues stood disposed;
From the high ceiling, perfume breathing, hung
Lamps rich, pomegranate-shaped, and golden-swung.
Gorgeous the board with massive metal shone,
Gorgeous with gems arose in front a throne:
These through the Orient lattice saw the sun.
If gold there was, of meat and bread was none,
Save one small loaf; this stretched his hand and took
Ahab Mohammed, prayed to God, and broke:
One half his yearning nature bid him crave,
The other gladly to his guest he gave.
"I have no more to give," he cheerily said:
"With thee I share my only loaf of bread."
Humbly the stranger took the offered crumb,
Yet ate not of it, standing meek and dumb;
Then lifts his eyes—the wondering Ahab saw
His rags fall from him as the snow in thaw.
Resplendent, blue, those orbs upon him turned;
All Ahab's soul within him throbbed and burned.
"Ahab Mohammed," spoke the vision then,
"From this thou shalt be blessed among men.
Go forth—thy gates the Mede bewildered flees,
And Allah thanks thy people on their knees.
He who gives somewhat does a worthy deed,
Of him the Recording Angel shall take heed.
But he that halves all that his house doth hold,
His deeds are more to God, yea, more than finest gold!"

SPEAK GENTLY

This is a very old lesson in conduct, which has seen service in many children's books for fifty years or more. We can scarcely dignify it with the name of poetry, but as moral teaching in rhyme it is still worthy of repetition. Usually printed without the name of its author, it was most probably written by David Bates, an American poet, who lived and worked in Philadelphia about the middle of the last century.

SPEAK gently!—It is better far
To rule by love than fear—
Speak gently—let not harsh words mar
The good we might do here!

Speak gently!—love doth whisper low
The vows that true hearts bind;
And gently Friendship's accents flow—
Affection's voice is kind.

Speak gently to the little child!
Its love be sure to gain;
Teach it in accents soft and mild,
It may not long remain.

Speak gently to the young, for they
Will have enough to bear;
Pass through this life as best they may,
'Tis full of anxious care!

Speak gently to the aged one,
Grieve not the careworn heart;
The sands of life are nearly run,
Let such in peace depart.

Speak gently, kindly to the poor—
Let no harsh tone be heard;
They have enough they must endure,
Without an unkind word!

Speak gently to the erring—know
They may have toiled in vain;
Perchance unkindness made them so;
Oh! win them back again!

A LIFE LESSON*

James Whitcomb Riley is one of the most charming of all the American poets, and none, except the late Eugene Field, many of whose pieces have appeared in our book, has equalled him in his poems of child-life. The following, however, is not exactly a children's poem, but is a tender little study of one who grows up to meet unhappiness, and a reminder that the joys this world takes away are small compared with those the truly religious life has to offer us.

THERE, little girl, don't cry!
They have broken your doll, I know;
And your tea-set blue,
And your playhouse, too,
Are things of the long ago.
But childish troubles will soon pass by.
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your slate, I know;
And the glad, wild ways
Of your schoolgirl days
Are things of the long ago;
But life and love will soon come by—
There, little girl, don't cry!

There, little girl, don't cry!
They have broken your heart, I know;
And the rainbow gleams
Of your youthful dreams
Are things of the long ago;
But heaven holds all for which you sigh—
There, little girl, don't cry!

* From "Child Rhymes," copyright, 1899.
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THE WORK OF THE POETS

Arthur O'Shaughnessy, the author of these dreamy verses, was born in 1844. He became an assistant, first in the library, and afterwards in the natural history department of the British Museum, and died in 1881 at the early age of thirty-seven. From this poem we may learn that he held the very highest opinions of the poet's mission and influence.

WE are the music-makers,
And we are the dreamers of dreams,
Wandering by lone sea-breakers,
And sitting by desolate streams;
World-losers and world-forsakers,
On whom the pale moon gleams:
Yet we are the movers and shakers
Of the world for ever, it seems.

With wonderful deathless ditties
We build up the world's great cities,
And out of a fabulous story
We fashion an empire's glory:
One man with a dream, at pleasure,
Shall go forth and conquer a crown;
And three with a new song's measure
Can trample an empire down.

We, in the ages lying
In the buried past of the earth,
Built Nineveh with our sighing,
And Babel itself with our mirth;
And overthrew them with prophesying
To the old of the new world's worth;
For each age is a dream that is dying,
Or one that is coming to birth.

*THE GLADNESS OF NATURE

American poets have largely found an abiding pleasure in singing the praises of wood and river, and William Cullen Bryant yielded to none in his willing homage to Nature. His devotion is proved by the many touches in this poem that show how closely he observed all things, from a dancing leaf to a flying cloud, from the twittering wren to the jovial, beaming sun. The hang-bird, or hang-nest, as it is often called, builds a nest like a huge pear turned upside down, or sometimes like an open cup, hanging on the branch of a tree.

IS this a time to be cloudy and sad,
When our mother Nature laughs around;
When even the deep blue heavens look glad,
And gladness breathes from the blossoming ground?

There are notes of joy from the hang-bird and wren,
And the gossip of swallows through all the sky;
The ground-squirrel gaily chirps by his den,
And the wilding bee hums merrily by.

The clouds are at play in the azure space,
And their shadows at play on the bright-green vale;
And here they stretch to the frolic chase,
And there they roll on the easy gale.

There's a dance of leaves in that aspen bower,
There's a titter of winds in that beechen tree,
There's a smile on the fruit, and a smile on the flower,
And a laugh from the brook that runs to the sea.

And look at the broad-faced sun, how he smiles
On the dewy earth that smiles in his ray,
On the leaping waters and gay young isles—
Ay, look, and he'll smile thy gloom away.

*Published by permission of D. Appleton & Co.

A POET'S LAST THOUGHTS

Like other hapless sons of the muses, John Clare, who was born in the county of Northampton in 1793, went through many hardships. During a great part of his life his lot was that of a farm labourer, and long before he died, in 1864, his mind was unhinged. His fate will account to some extent, if not altogether, for the sadness of the following lines by him.

I AM! yet what I am who cares, or knows?
My friends forsake me like a memory lost.
I am the self-consumer of my woes;
They rise and vanish, an oblivious host,
Shadows of life, whose very soul is lost.
And yet I am—I live—though I am toss'd.

Into the nothingness of scorn and noise,
Into the living sea of waking dream,
Where there is neither sense of life, nor joys,
But the huge shipwreck of my own esteem
And all that's dear. Even those I loved the best
Are strange—nay, they are stranger than the rest.

I long for scenes where man has never trod—
For scenes where women never smiled or wept—
There to abide with my Creator, God,
And sleep as I in childhood sweetly slept,
Full of high thoughts, unborn. So let me lie—
The grass below; above, the vaulted sky.

THE SANDPIPER

Here is another instance of Nature worship on the part of an American poet. Celia Thaxter, who was born in 1836 and died in 1894, had a narrower range than her more distinguished compatriot Bryant, but yet warbled sweetly her native woodnotes wild. She was especially fond of the sea, perhaps because her father was for many years keeper of a lighthouse. The sandpiper is a lively little shore-bird that flits about from point to point in search of shell-fish.

ACROSS the narrow beach we flit,
One little sandpiper and I;
And fast I gather, bit by bit,
The scattered driftwood, bleached and dry.
The wild waves reach their hands for it,
The wild wind raves, the tide runs high,
As up and down the beach we flit—
One little sandpiper and I.

Above our heads the sullen clouds
Scud black and swift across the sky;
Like silent ghosts in misty shrouds
Stand out the white lighthouses high.
Almost as far as eye can reach
I see the close-reefed vessels fly,
As fast we flit along the beach—
One little sandpiper and I.

I watch him as he skims along,
Uttering his sweet and mournful cry.
He starts not at my fitful song,
Or flash of fluttering drapery.
He has no thought of any wrong;
He scans me with a fearless eye.
Stanch friends are we, well tried and strong,
The little sandpiper and I.

Comrade, where wilt thou be to-night
When the loosed storm breaks furiously?
My driftwood fire will burn so bright!
To what warm shelter canst thou fly?
I do not fear for thee, though wroth
The tempest rushes through the sky:
For are we not God's children both,
Thou, little sandpiper, and I?

LITTLE VERSES FOR VERY LITTLE PEOPLE

WHEN the snow is on the ground,
Little Robin Redbreast grieves;
For no berries can be found,
And on the trees there are no leaves.

The air is cold, the worms are hid;
For this poor bird what can be done?
We'll strew him here some crumbs of bread,
And then he'll live till the snow is gone.

"WILLY boy, Willy boy, where are you going?
I will go with you, if that I may."
"I'm going to the meadow to see them a-mowing,
I'm going to help them make the hay."

NOW what do you think
Of little Jack Jingle?
Before he was married
He used to live single.

THE gossips of the village—see,
Their fine lace caps are wearing.
They sip their dainty cups of tea,
White sugar they are sharing.

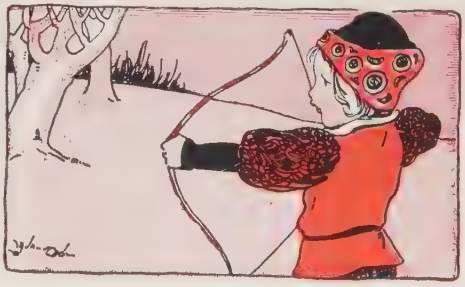
Their fingers shine with golden rings,
But—duty never matters!
Nothing is ready for the men,
And under—they are tatters!

HUSH-A-BYE, babby, lie still with thy daddy,
Thy mammy is gone to the mill
To get some wheat, to make some meat,
So pray, my dear babby, lie still.

A DUCK and a drake,
And a nice barley cake,
With a penny to pay the old baker;
A hop and a scotch
Is another notch,
Slitherum, slatherum, take her!

PUSSY sits beside the fire,
How can she be fair?
In comes the little dog,
"Pussy, are you there?
So, so, Mistress Pussy,
Pray, how do you do?"
"Thank you, thank you, little dog,
I'm very well just now."

THE white dove sat on the castle wall,
I bent my bow, and made her fall;



I picked her up, feathers and all,
And I rode away from the castle wail.

"LEND me thy mare to go a mile."
"She is lamed, leaping over a stile."
"Alack, and I must keep the fair—
I'll give thee money for thy mare."
"Oh, oh, say you so!
Money will make the mare to go."

HE loves me, he don't!
He'll have me, he won't!
He would if he could,
But he can't, so he don't!

I LOVE you well, my little brother,
And you are fond of me;
Let us be kind to one another,
As brothers ought to be.
You shall learn to play with me,
And learn to use my toys;
And then I think that we shall be
Two happy little boys.

Two little kittens, one stormy night,
Began to quarrel and then to fight;
One had a mouse and the other had none,
And that's the way the quarrel begun.
"I'll have that mouse," said the biggest cat.
"You'll have that mouse? we'll see about that!"
"I will have that mouse," said the eldest son.
"You sha'n't have the mouse," said the little one.
I told you before 'twas a stormy night
When these two little kittens began to fight;
The old woman seized her sweeping-broom,
And swept the two kittens right out of the room.
The ground was covered with frost and snow,
And the two little kittens had nowhere to go;
So they laid them down on the mat at the door,
While the old woman finished sweeping the floor.
Then they crept in, as quiet as mice,
All wet with the snow, and as cold as ice,
For they found it was better, that stormy night,
To lie down and sleep than to quarrel and fight.

Wassail! Wassail! all over the town,
Our toast it is white, our ale it is brown,
Our bowl it is made of the good maple-tree;
We be good fellows all—and I drink to thee.

Here's to Grey Dobbin, and to his right ear,
God send our master a happy new year!
A happy new year as e'er he did see,
With my wassailing-bowl I drink to thee.

Here's to Black Beauty, and to his right eye,
God send our mistress a good Christmas pie;
A good Christmas pie as e'er I did see—
With my wassailing-bowl I drink to thee.

THE PRINCE GOES ON HIS TRAVELS

The Prince travelled with five servants, by whose help he won the lovely Princess—the tall man, the fat man, the man with wonderful ears, the man with wonderful eyes, and the man who shivered in summer and was hot in winter.

THE PRINCE'S FIVE SERVANTS

CONTINUED FROM 4227

MANY, many years ago there lived a beautiful Princess, who was so charming that everyone loved her. But, in spite of all the love and admiration that was showered upon her, the Princess was anything but happy, for she had the cruellest of mothers, who never seemed so happy as when she was making others miserable.

It can easily be understood that with such a Queen the Palace was by no means the most agreeable place to live in, and the Princess eagerly looked forward to the day when some brave Prince would fall in love with her, and take her away to a home of her own. But, alas! no sooner did a suitor appear than the old Queen set him, as the price of her daughter's hand, some impossible task, on the understanding that failure should mean nothing less than death; and so the poor man lost not only his bride, but his head as well.

One day, when the Princess was walking in the forest with her maids, idly wondering whether there could be another being in the whole wide world so wretched, a handsome Prince rode by

"What a lovely girl!" thought the Prince; and he watched her till she passed out of sight.

Now, the Prince had fallen in love with the Princess at first sight, and he determined to win her. Losing no time, he set out the next day for the Palace. On the outskirts of a wood, through which he had to pass on his way, he noticed what he took to be a huge beast lying by the wayside. But, on going nearer, he found that it was no beast, but a man—quite the biggest man he had ever seen. He touched him with his foot, and the man stood up, and asked:

"Do you need a servant?"

"If I did," returned the Prince, "I am sure I don't know what I should do with such a fat fellow as you."

"What does my size matter," answered the man, "so long as I discharge my duties faithfully?"

This answer so pleased the Prince that he engaged him on the spot. When they had gone along a little farther, the Prince came across a man who lay on the grass with his ear close to the ground.

"What are you doing?" asked the Prince.

"Listening," said the man. "I can hear all that goes on in the world."

"You may be valuable to me some day," said the Prince. "Follow me."

Before they had gone very far they came across a pair of feet, and, a little farther on, a pair of legs; and then they found a body; and then, at last, the head.

"Bless me," exclaimed the Prince. "what an extraordinary man!"

"Oh," replied the man, "this is nothing to what I can do when I

stretch myself to my full length! When I choose I can make myself three times as tall as the highest mountain."

"Follow me," said the Prince. "Some day you may be of great service."

The man muttered some words to himself, and in an instant became an ordinary man again.

This strange little band journeyed on till they came upon a man who was sitting in the blazing sun, shivering as if he had the ague.

"Are you ill that you shiver in this heat?" inquired the Prince kindly.

"Indeed," answered the man, "something must be wrong with me, for the sun, instead of warming me, sends cold thrills over me; while the cold and ice of winter oppress me so that I often faint with the heat."

"How very extraordinary!" said the Prince. "Still, as you seem to have nothing to do, follow me, and I will take you into my service."

A little farther on they found a man who was standing on tiptoe, eagerly scanning the land.

"For what are you looking?" asked the Prince.

"I am watching the world," replied the man. "My eyes are so sharp that I can see from end to end. If you need a servant, you may find me very useful."

"True," said the Prince. "Follow me."

When they arrived at the Palace, the Prince was shown before the Queen, of whom he begged the hand of the lovely Princess.

"The man who would win her," replied the old Queen, "must earn her."

The Prince was prepared for this, and asked what his task was to be.

"There are three," replied the Queen. "First, bring me the ring that I dropped in the Red Sea."

"That is simple," said the man who could make himself as tall as the highest mountain.

"Why, there it is!" exclaimed the sharp-eyed man, "just by that green rock." Whereupon the tall man stretched himself to his full length, bent over, and picked it up.

The Queen was furious when the Prince handed her the ring, although she pretended to be pleased.

"You have indeed done well," said she; "but you may not find your second task so easy. Yonder are a hundred fat oxen; these you must eat before noon. And in a cellar below are one hundred casks of wine; these you must drink so that not a drop remains."

"May I invite a guest?" asked the Prince.

"Certainly," replied the Queen, with a spiteful laugh. "One, and one only."

The Prince turned and found the fat man at his side.

"Just leave this to me, Master," said he, well pleased at the prospect. And by noon nothing remained of that goodly feast but a hundred empty wine-casks and a pile of bones.

This time the Queen could scarcely hide her anger.

"Your third task you may find more difficult to perform," said she. "At sunset I shall bring my daughter to your apartments, and leave her in your care. See to it that she is still there when I return at midnight."

"That does not sound impossible," thought the Prince; "with the help of my five servants I think I can manage to keep the Princess."

At dusk the Princess arrived. The Prince led her to a low-cushioned seat by the window, and the Queen went away. As the door closed behind her, the Prince clapped his hands, and immediately his servants made silent preparations for the watch. The tall man stretched himself to his full length, and wound himself round and round the little house, so that none could go in nor pass out; the sharp-eyed man closely watched the movements of the Queen; while the man with the wonderful hearing remained motionless with his ear to the ground.

Within the room all was silence. The moon streamed through the open window on to the face of the lovely Princess, who sat with folded hands gazing idly at the stars; and behind, his face in shadow, stood the Prince watching her, and wondering at her marvellous beauty.

But suddenly, as the clock struck eleven, the old Queen threw a spell over them, so that they all fell asleep; and while they slept the Princess vanished. But, clever as she was, the old Queen had no powers of enchantment after a quarter to twelve, and as the clock chimed they all awoke. The Prince at once started to his feet.

"Alas, alas! my beautiful lady is gone! All is lost!" he exclaimed.

"Not so," cried the man with the wonderful ears. "I hear her weeping, but the sound comes from afar."

"I see her seated on an enchanted rock three hundred miles away," cried the sharp-eyed man.

"Describe the place," said the tall man, "and I will bring her here in three minutes."

When the old Queen came back at twelve o'clock, she was amazed to find her daughter sitting just where she had left her.

"Take her; you have won your bride," she said to the Prince. But as she passed she whispered to the Princess:

"I would scorn to be won by a pack of servants."

The idea was so hurtful to the pride of the Princess that she turned to the Prince, and said:

"Before you can win *my* consent, one of your wonderful servants must consent to be flung on to three hundred burning logs of wood, and there remain till the fire has burnt itself out."

"You hear," said the Prince to his servants. "Will any of you consent?"

"I will," answered the frosty man, stepping forward without any hesitation.

So the logs were brought, and the fire started; and for three whole days the Court watched the man who lay on a burning pile, while his teeth chattered so that he could scarcely keep still.

When the last flame had flickered out, the frosty man stepped down, declaring that he had never felt so cold in his life.

The Princess, who was delighted that her handsome lover had once more triumphed, held out her hand, and the Prince bent over and kissed it.

Now that the old Queen no longer had any excuse for delay, the bridal day was fixed, and the wedding took place amid scenes of great enthusiasm, for the Princess was much loved by her people, and the Prince had shown himself to be as clever as he was handsome.

After the ceremony, the Princess arrayed herself in her finest dress and her most costly jewels, and together she and the Prince set out for the Palace. Here they were received with great kindness by the old King and Queen, and they lived very happily together all the remainder of their lives.

HOW THE BAD NEWS REACHED THE KING

THERE is a good story told of that strange personage, Frederick the Great of Prussia. He was a violent, fierce, savage man, and yet he was fond of music, and liked to have at his Court clever and distinguished philosophers, such as Voltaire. Everybody was very much afraid of this monarch, who at one moment might be laughing and joking, and at the next ordering a man to be flogged or executed.

To one creature he was most passionately devoted, and this was a horse. It was the handsomest charger imaginable, fit for a king to ride upon, and so intelligent and affectionate that it quite softened and won the heart of its royal master.

One day, when he was very much put out and busy, he learned that this favourite was ill. In a fit of petulant rage, feeling his own insignificance at not being able to keep even a horse alive, even though he was a great monarch, he called out that any man who should inform him that the horse was dead should be instantly hanged.

A few days passed without any change in the charger's condition, but one morning the equerries, in going their round of the stables, were met by the groom, who told them that the horse was dead.

Just imagine their consternation. Who was to tell the King? Who was to run the risk of being hanged? They stood talking and proposing various plans until the hour arrived for the daily bulletin to be delivered to his Majesty. At that moment one of the youngest equerries told the groom not to be afraid, and himself went to the King.

"Well!" demanded Frederick; "how is the horse?"

"Sire," replied the equerry, "the horse is in his usual place. He is lying down. He does not move. He has no strength. He does not eat. He does not drink. He does not sleep. He does not breathe. He does not——"

"Then, indeed," cried the King impatiently, "he must be dead."

"Your Majesty has spoken truly," replied the equerry calmly; "and it is you, sire, who have announced the fact."

THE FABLES OF ÆSOP THE SLAVE

THE CAT AND THE MICE

A CERTAIN house was overrun with mice, so its owners got a cat, who caught and ate a great number of the mischievous little animals.

The mice, finding their numbers growing thinner, consulted together how best to preserve themselves from the jaws of the cat, and they decided that none of them should go down below the top shelf, where the cat could not get at them.

The cat, finding that the mice no longer came down, got very hungry, and resolved upon a clever trick. She hung by her hind legs on a nail on the wall, and pretended to be dead, hoping by this means to persuade the mice to come down.

She had not been hanging there long before a cunning old mouse peeped over the edge of the shelf, and said: "Ah, my good friend, you may hang there as

long as you like; but I certainly would not trust myself with you even if I knew that your skin was stuffed with straw."

It is better to be on the safe side.

THE TRAVELLERS AND THE BEAR

TWO men, travelling through a forest together, promised to stand by each other in case any danger should threaten them. They had not gone very far when a bear came rushing out of the wood.

Upon this one of the travellers, being a good climber, got up into a tree. The other, who could not climb, fell flat upon his face and lay quite still, holding his breath. The bear came up and smelt him, but, supposing him to be dead, went back into the wood without doing him any harm.

When the danger was over, the man who had climbed the tree came down to his companion, and asked him what it was the bear said when he put his mouth so close to the man's ear.

"Why," answered the other, "he advised me to take care in future not to put

any trust in such a coward as you are, or I should always be deceived."

A true friend will always stand by his companion in danger.

THE FIR-TREE AND THE BRAMBLE

A TALL, straight fir-tree that stood towering up in the forest was very proud of his height and dignity, and he despised the little shrubs which grew beneath him. One day a bramble asked him why he was so proud.

"Because," replied the fir-tree, "I look upon myself as the finest tree for beauty of any in the forest. My top shoots up towards the clouds, and my branches spread round in constant beauty, while you crawl on the ground, liable to be crushed by every animal that comes near."

"All this may be true enough," replied the bramble; "but when the woodman has marked you for cutting

down, and the axe comes to be applied to your root, I fancy you will wish that you could change places with me."

Pride always goes before a fall.

A PAIR OF OLD BOOTS

A LITTLE servant in London, ill-paid, but kindly treated, asked her mistress one morning if she might have the master's old pair of shoes, or boots, as the English say.

"Why, Mary," she said, "you could never wear such old boots as those; they are worn to the soles."

The maid smiled at her mistress.

"I wasn't thinking of keeping them for myself, m'm," she answered; "I was thinking of giving them away to a friend."

The boots were given. The maid wrapped them up in brown paper, fastened the packet with string, and addressed it. She took a long time writing the address, working her tongue with the movements of the pen, and stopping every now and then to be quite sure about the spelling of the words.

"It's a long time since I wrote," she said. "I'm ashamed to say I've almost forgotten how to spell properly."

Her mistress, looking over her shoulder, saw that the packet was addressed to the Barefoot Mission of the Ragged School Union.

"HE GAVE ME THE BOOTS, AND I RAN HOME WITH THEM."
Specially drawn for THE CHILDREN'S ENCYCLOPÆDIA by Lady Stanley

"It was just such a pair of boots as this," said the little maid, "as saved me. I was at the school one day, all in rags and tatters, when a parcel arrived, same as this one, and inside it was a lovely pair of gentlemen's old boots. The superintendent saw me looking at them. 'Mary,' he said, 'how would your father like a pair of nice boots?' 'Oh, not half!' I answered him. I was half laughing and half crying. 'Well,' says the superintendent, 'you take these home to him, and tell him, with my love, that many a man has walked to heaven in worse boots than these. Cast off they may be, but so are plenty of children in London, and plenty of those cast-off children find God for their Father.' He gave me the boots, and I ran home with them. If you had seen father! He put 'em on; he walked up and down the room; he sat and crossed his legs; he looked at 'em, and said: 'Bread or no bread, I'll sport a penny to get 'em shined.' And he really did. He came back with them, and I said to him: 'You must mind, father, what the superintendent said, won't you, now?' 'Mary,' he says, 'you've got no mother; you've acted as mother, washerwoman, and handy-man to your little brothers and sisters, and like a mother-in-law to me. And now you've done something you never dreamed of doing. You've made a gentleman of your father, Mary. I intend to live up to these boots.' And, do you know, m'm, they made *that* difference to him that he shaved himself every day, took more pride in his washing, and looked so nice and happy that he got a regular job, and kept it for over four months. We was more happy then than ever we'd been before. We was always polishing up and hoping. We never was what we were before father got the boots."

The mistress asked what happened afterwards; but Mary did not care to speak about it.

"It wasn't quite so happy; but it was never, never what it was before," she said. "He pawned the boots, and then he went right back again, until I earned a shilling and got them out. It was like that, off and on, for years—him pawning and me getting them out—till he couldn't pawn them because they

were so wore out. 'Oh, Mary,' he used to say, 'if I could only live up to them boots! I've tried, my girl. You know I've tried. And perhaps I'm better for having tried. We're all better for it. But, Mary, your father's got a weak heart—a weak heart, Mary; that's his trouble. Ah, my girl, India kills hundreds of men!' He always spoke in that fashion. He was very kind. We were very fond of him, and none of us is likely to forget how father tried to live up to the old boots, and we all made a start from that day."

The mistress saw the address on the package, and said she would save the postage by carrying it there herself. Mary's story had made her curious. When she arrived at the school it was crowded with children, the poorest of the poor—children with famished faces, ragged, grubby, bootless some of them, and all thin—terribly, dreadfully thin. She told the story to the superintendent, a gentleman who had worked for many years in this service.

"I remember your little Mary perfectly," he said; "her father had been a soldier—a sergeant, I think—and the boots really did revive his ideas of self-respect. And now I will show you a still more wonderful thing."

The school closed. The superintendent kept three miserable children, one of them a cripple, behind.

"I want to go home with you," he said.

One of the children was a big girl. She whispered to the superintendent like one entranced, and glanced at the lady. "Oh, it will be all right, dear!" he answered cheerfully.

As they walked through the streets, he said to the lady: "These boots sent by Mary shall also go to a soldier."

They arrived in a court which was dark, ill-smelling, and grimy. In a small room they found a handsome-looking but tattered man addressing envelopes at a table, while his wife lay sprawled upon a ragged bed, drunk and asleep. The man greeted the superintendent rather roughly, frowned on the lady, and then turned to the children with a certain masculine tenderness in his troubled eyes. "Have you enjoyed yourselves?" he demanded.

And they said "Yes," putting their arms round his neck.

The superintendent left the packet on the table without opening it, said that it came from the daughter of an old soldier, and withdrew.

"That man," he said to the lady, when they were outside the door, "commanded one of the best of our cavalry regiments. He is a man of distinguished family. He has come down to this through devotion to his wife. She has ruined him by drink. And he devotes himself to her, and strives to save her, because he says that he was the cause. At one time he was a drinker. Tell Mary that another old soldier has got her pair of boots."

The lady became so interested in this work that she sent all her old garments, and sometimes a few shillings—for she was poor herself—to the Ragged School Union. Mary soon got to know the Colonel, and on her afternoons out she would go to the dingy room, scrub it, clean it, dust it, and put it to rights.

She is now living in hopes that the Colonel's wife, who is lying at death's door in an hospital, will come back to a little room so bright and hopeful that she will try to live up to it.

"The thing is, m'm," Mary told her mistress, "to give everybody something they can live up to—even if it's a pair of old boots. It's like heaven. If you try to live up to heaven, life is not so hard, and the grave isn't never so black and cold as it was before."

LEGENDS OF TOWN AND COUNTRY

THE MAN IN THE MOON

ONE Sunday morning an old man went to a forest and cut a faggot of firewood, and put it on his shoulder, and began to trudge home. But an angel came, and said to him :

" Do you know this is Sunday on earth, when all men rest from labour ? "

" Sunday on earth, or Monday in heaven," said the old man, " it's all the same to me."

" Then," said the angel, " as you do not keep Sunday on earth, you shall live in a Moon-day in heaven, and there you shall carry your faggot until the Day of Judgment."

And the old man rose up to the moon, and there, on a clear night, you can still see a great shadow, as of a man with a faggot on his shoulder. It is said that :

> The man in the moon
> Came down too soon,
> And asked his way to Norwich.

But there is no news of his ever arriving at that great and famous city.

ST. KEYNE'S WELL

CORNWALL is, of all the counties of England, the one most rich in folk-lore and legend. The names of many saintly men and women who brought the Gospel to the pagans who dwelt there still linger in the villages. Many, too, are associated with holy wells, and the following is the story of St. Keyne's Well.

St. Brechan, the ancient Welsh king who built the town of Brecknock, had twenty-four children, and fifteen of them became saints, like their royal father.

Chief among them was a maiden of ravishing beauty whose name was Keyne. She wandered about England, preaching to the pagans and converting them, and her name is preserved in the village of Keynsham, in Somerset, and in St. Keyne's Well, in Cornwall. The well lies near the spot where she died, and it is said that before she died she planted about it four trees—the willow, the oak, the elm, and the ash—and blessed the water. And because the well was blessed by the saintly maiden, the water is reputed to have a strange virtue. Newly-married couples often come to drink from the well, and then there is a struggle. If the bridegroom is the first to taste the water, he henceforward obtains the mastery over his wife. If the bride is able to drink first, she ever afterwards obtains in all things the complete mastery over her husband.

THE CHEST OF CALLER PIT

CALLER PIT is a watery hollow lying near Southwood, in Norfolk, and there was an old saying that an iron chest filled with gold lay at the bottom of it.

So, one hot summer, when the water had been dried up, two Southwood men dug deep down in the pit, and there, sure enough, they found the chest. It was very heavy, but they managed to raise it up, and one of the men joyfully cried, as he clutched the iron ring at the top of the chest :

" We've got it now, and the Spirit of the Pit couldn't take it away from us."

A thick black smoke at once arose from Caller Pit, and out of the black smoke came a great black hand, and seized the chest. The two men clung on wildly to the iron ring, but all in vain. The black hand wrenched the chest away, and all they got was the iron ring. This ring is now fixed to the door of Southwood Church, but though Caller Pit is now often dry, nobody has ever again found the chest of gold there.

THE BIDDENDEN MAIDS

ON Easter Sunday in every year a thousand cakes are given away to all persons attending service in the church of the picturesque little village of Biddenden, in Kent. On each of the cakes there is stamped a rough, antique picture of two women joined together at the shoulders and hips.

These are the Biddenden Maids, and their names are Elizabeth and Mary Chulkhurst. They were born in Biddenden in the year 1100, and for thirty-four years they lived joined together in the manner shown on the cakes. When one of them died, her sister's sorrow was great, and she said :

" Together we came, and together we must go."

And she passed away six hours after her sister, leaving to the churchwardens of Biddenden twenty acres of land, on the condition that the income should be spent in giving away cakes every Easter in commemoration of the sad event.

FOOLS AND JESTERS AND KINGS

ALMOST as old as history is the Court fool, or jester, of whom we read in so many of Shakespeare's plays. The reason for these droll creatures is not generally known. They were employed to aid digestion.

When we laugh, we exercise certain muscles which play an important part in the digestion of food. The more we exercise these muscles the better can we digest our dinners. People in ancient times, who ate enormously, soon discovered that a dinner at which they sat glum and silent, or at which they only talked about serious things, gave them a good deal of bother to digest. And so funny fellows were procured, who by their antics set the eaters roaring with laughter.

But, as the world moved on, the absurd follies of fools ceased to make men laugh, and instead of the fool came the jester. There was all the difference in the world between the Court fool and the Court jester. The fool was a mere knockabout clown; the jester was a polished and brilliant wit, an inimitable teller of good stories, a critic of politics, religion, and manners. The jester looked down upon the clown, and despised him for an ignorant person of low degree. The jester became an influential courtier, one of the most powerful men at the King's elbow.

He could avert war, save a noble from execution, get justice for the poor, and improve manners. So long as he kept the King amused, or served his Majesty with the sauce of laughter at dinner, the jester was one of the very first men in the kingdom. The first Court fool known in history was a woman. This was Iamby, who was famous at the Court of the Queen of Eleusis for her frolicsome humour, her funny jokes, her playful gambols, and her merry stories.

THE FABLES OF ÆSOP IN FRENCH

THE ENGLISH VERSION OF THESE FABLES IS GIVEN ON PAGE 877

LE LOUP ET LA CIGOGNE

UN loup, mangeant son dîner, un jour, avala un os qui s'arrêta dans sa gorge. Il errait en hurlant, demandait à tous les animaux qu'il rencontrait de l'aider et promettait une forte récompense à qui retirerait l'os. Enfin, une cigogne, avec un cou et un bec longs et minces, entreprit la chose.

Elle introduisit son long bec dans la gorge du loup, saisit l'os et le retira; mais quand elle demanda sa récompense, le loup répondit en riant: "Estimez-vous heureuse que je n'ai pas mordu votre tête quand elle était dans ma gueule."

Il y a des gens sans reconnaissance pour les services rendus.

LA GRENOUILLE ORGUEILLEUSE

UN bœuf qui paissait dans un champ, mit par hasard son pied au milieu d'une famille de jeunes grenouilles et en écra a une. Les autres racont rent à leur mère ce qui était arrivé et dirent que l'animal en question était le plus gros qu'ils eussent jamais vu.

"Était-il aussi gros que ceci?" demanda la vieille grenouille en se gonflant, de la façon particulière aux grenouilles.

"Oh, bien plus!" dirent les petites grenouilles.

"Aussi gros que ceci?" demanda-t-elle, en redoublant ses efforts.

"Oui, mère," dirent-elles, "vous ne seriez jamais aussi grosse, même en vous gonflant à en crever."

La vieille et sotte grenouille fit encore un effort pour se gonfler davantage, et elle éclata et mourut.

N'essayez jamais de vous faire prendre pour une personne plus importante que vous n'êtes en réalité.

LE GEAI VANITEUX

UN geai était si vaniteux que ses simples plumes noires ne le satisfaisaient pas. Il ramassa un grand nombre de belles plumes tombées de la queue d'un paon et les attacha avec soin sur son dos.

Puis il essaya de se mêler à la famille des paons comme s'il en faisait partie, mais sa ruse fut bientôt découverte et les paons le frappèrent tant à coups de bec, qu'il fut heureux de s'échapper.

Il retourna chez ses anciens amis, les geais; mais ils le chassèrent et ne voulurent plus être ses amis.

Nous serons découverts, si nous prétendons être plus que ce que nous sommes.

THE NEXT STORIES ARE ON PAGE 4373

PERRY'S VICTORY ON LAKE ERIE

Probably no battle in our history has so stirred the American people as the victory of young Perry on Lake Erie during the War of 1812. The loss of Detroit soon after the war began was a great blow, for the British then came into possession of the whole Northwest Territory, and with it passed the control of Lake Erie. Now Detroit without the command of the lake would have been of little use to the British, for at that time it was impossible to send sufficient supplies overland to the British soldiers stationed there. So if the Americans could get back the control of Lake Erie the first step toward recapturing Detroit, and in the end the whole of the Northwest Territory, would have been taken.

The young naval officer who was to secure the control of the lake

Things looked unfavourable for the Americans, when Oliver Hazard Perry, a young naval officer, was sent to Presqu' Isle, on Lake Erie, to take charge of a small squadron that was being built there. When he arrived, he found the keels of two brigs laid and three gunboats well under way. The two brigs were the Lawrence, named after the unfortunate captain of the Chesapeake, and the Niagara. With a gang of ship carpenters the young Perry set to work to finish building and to equip this little squadron in a place that was almost a wilderness. They cut down trees from the western shore of the lake and used the green timber for the vessels, while most of the material for equipping the ships had to be brought 500 miles from the seaboard. After remarkable energy and perseverance, the work was finally done, and with the little squadron of vessels, two of which, as Perry put it, were growing in the woods last spring, he set sail on Lake Erie in search of the British fleet.

Now the British had been building ships, too, and their new ship, the Detroit, was nearly ready for service.

The English also build ships

The quick work of the American seamen had aroused the alarm of the British. Captain Barclay, one of Nelson's veterans, in command of the British fleet, meant to have his squadron on the lake and keep the American ships blockaded near Presqu' Isle, but Perry was too quick for him. His ships were already on Lake Erie and he was on the lookout for the British.

A battle necessary for both sides

The British squadron, finding Perry in full control of the lake, remained at Malden, on the Detroit River. Captain Barclay had great trouble to get a crew and he was determined not to come into action until he had what he thought was the full equipment of seamen. But difficulties about the food supply were staring him in the face. He could no longer get food in his neighbourhood and the presence of the American squadron made it impossible for him to reach Long Point, the supply station, without coming into open fight.

In the meantime the American squadron had decided not to wait for the enemy, but to sail over to Malden and attack the British at that place. So Perry's fleet set sail for that purpose. At sunrise on September 10, 1813, the lookout at the masthead of the Lawrence sighted the British squadron in the northwest. Captain Barclay's seamen were hungry and he had decided that he must open communications with Long Point even if it meant fight.

The fleets compared

There was some difference in the strength of the two fleets. Perry had

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nine ships while the British had six, but the latter carried more guns. The British vessels were larger but their guns were smaller; and then, Captain Barclay had served under Nelson at Trafalgar, while the young American commander was but 27 years of age and had to make up in spirit what he lacked in experience. But he had spirit enough for what was to follow. "To windward or leeward they shall fight today," was his command when the British hove in sight.

This well-known painting shows the dramatic moment when Commodore Perry, leaving his shattered flagship, the Lawrence, was rowed over to the Niagara to begin the battle with renewed energy. The flag he took with him was not the stars and stripes however, but was the blue banner on which were Lawrence's dying words, "Don't Give Up the Ship."

THE BATTLE RAGES

Perry in his flagship, the Lawrence, displaying a blue banner, bearing the words, "DON'T GIVE UP THE SHIP," advanced, but the British in line in close order awaited the attack. The Lawrence hailed. The British waited until she was within range, and then made her a target for their fire. The fighting that followed was most desperate and the Lawrence was soon almost a wreck. Perry fought her until nearly all of his men had fallen. It was a supreme moment — most men would have surrendered. He saw it would be madness to stay longer in his shattered ship. With eight men, and his little twelve-year-old brother, he jumped into a row boat and, standing, blue flag in hand, made straight through a shower of shot and shell for the Niagara, another vessel of his fleet, which had not suffered much harm. With renewed energy the battle then raged with greater violence than before. The few men left on the Lawrence were compelled to haul down their flag, but the British were too busy to take possession of her. Perry sailed into the very midst of the British fleet. He tore through the enemy's lines, pouring broadsides right and left. In fifteen minutes the English captain was compelled to surrender and Perry's great victory on Lake Erie was won. For the first time in history a despatch bore the message that an entire English fleet had been captured. "We have met the enemy and they are ours — two ships, two brigs, one schooner and one sloop."

WHAT THIS STORY TELLS US

JAMES FENIMORE COOPER'S stirring tale of the American Revolution, The Spy, has the scene laid around New York, and shows the conflict of Whig and Tory as well as of the regular forces on each side. The prisoner in the story, Henry Wharton, is a Loyalist and, while visiting his father and sisters within the American lines, was captured and is now on trial for his life. He was condemned to death because of his association with Harvey Birch, who was believed to be a British spy, but was in fact one of Washington's confidential scouts, though this fact was not known until after Birch's death. It may interest you to know that Wharton escaped by the aid of Birch. You must, however, read the whole book, for no extract can do it justice.

THE TRIAL OF THE SPY

"BRING forth the prisoner," said Singleton, with a wave of the hand.

The sentinels dropped the points of their bayonets towards the judges, and Henry Wharton advanced, with a firm step into the centre of the apartment. All was now anxiety and eager curiosity. Frances turned for a moment in grateful emotion, as the deep and perturbed breathing of Dunwoodie reached her ears; but her brother again concentrated all her interest in one feeling of intense care. In the background were arranged the inmates of the family who owned the dwelling, and behind them, again, was a row of shining faces of ebony glistening with pleased wonder. Among these was the faded lustre of Cæsar Thompson's countenance.

"You are said," continued the president, "to be Henry Wharton, a captain in his Britannic Majesty's 60th regiment of foot."

"I am."

"I like your candour, sir; it partakes of the honourable feelings of a soldier, and cannot fail to impress your judges favourably."

"It would be prudent," said one of his companions, "to advise the prisoner that he is bound to answer no more than he deems necessary; although we are a court of martial law, yet, in this respect, we own the principles of all free governments."

A nod of approbation from the silent member was bestowed on this remark, and the president proceeded with caution, referring to the minutes he held in his hand.

"It is an accusation against you, that, being an officer of the enemy, you passed the pickets of the American army at the White Plains, in disguise, on the 29th of October last, whereby you are suspected of views hostile to the interests of America, and have subjected yourself to the punishment of a spy."

The mild but steady tones of the speaker, as he slowly repeated the substance of this charge, were full of authority. The accusation was so plain, the facts so limited, the proof so obvious, and the penalty so well established, that escape seemed impossible. But Henry replied, with earnest grace, —

"That I passed your pickets in disguise, is true; but — "

"Peace!" interrupted the president; "the usages of war are stern enough in themselves; you need not aid them to your own condemnation."

"The prisoner can retract that declaration, if he please," remarked another judge. "His confession, if taken, goes fully to prove the charge."

"I retract nothing that is true," said Henry, proudly.

The two nameless judges heard him in silent composure, yet there was no

exultation mingled with their gravity. The president now appeared, however, to take new interest in the scene.

"Your sentiment is noble, sir," he said; "I only regret that a youthful soldier should so far be misled by loyalty as to lend himself to the purposes of deceit."

"Deceit?" echoed Wharton; "I thought it prudent to guard against capture from my enemies."

"A soldier, Captain Wharton, should never meet his enemy but openly and with arms in his hands. I have served two kings of England as I now serve my native land: but never did I approach a foe, unless under the light of the sun, and with honest notice that the enemy was nigh."

"You are at liberty to explain what your motives were in entering the ground held by our army in disguise," said the other judge, with a slight movement of the muscles of his mouth.

"I am the son of this aged man before you," continued Henry. "It was to visit him that I encountered the danger. Besides, the country below is seldom held by your troops, and its very name implies a right to either party to move at pleasure over its territory."

"Its name, as a neutral ground, is unauthorised by law; it is an appellation that originates with the condition of the country. But wherever any army goes, it carries its rights along, and the first is the ability to protect itself."

"I am no casuist, sir," returned the youth; "but I feel that my father is entitled to my affection, and I would encounter greater risks to prove it to him in his old age."

"A very commendable spirit," cried the veteran; "come, gentlemen, this business brightens. I confess, at first, it was very bad, but no man can censure him for desiring to see his parent."

"And have you proof that such only was your intention?"

"Yes — here," said Henry, admitting a ray of hope; "here is proof — my father, my sister, Major Dunwoodie, all know it."

"Then, indeed," returned his immovable judge, "we may be able to save you. It would be well, sir, to examine further into this business."

"Certainly," said the president, with alacrity; "let the elder Mr. Wharton approach and take the oath."

The father made an effort at composure, and, advancing with a feeble step, he complied with the necessary forms of the court.

"You are the father of the prisoner?" said Colonel Singleton, in a subdued voice, after pausing a moment in respect for the agitation of the witness.

"He is my only son."

"And what do you know of his visit to your house, on the 29th of October last?"

"He came, as he told you, to see me and his sisters."

"Was he in disguise?" asked the other judge.

"He did not wear the uniform of the 60th."

"To see his sisters, too!" said the president with great emotion. "Have you daughters, sir?"

"I have two — both are in this house."

"Had he a wig?" interrupted the officer.

"There was some such thing, I do believe, upon his head."

"And how long have you been separated?" asked the president.

"One year and two months."

"Did he wear a loose great-coat of coarse materials?" inquired the officer, referring to the paper that contained the charges.

"There was an over-coat."

"And you think it was to see you, only, that he came out?"

"Me, and my daughters."

"A boy of spirit," whispered the president to his silent comrade. "I see but little harm in such a freak; 'twas imprudent, but then it was kind."

"Do you know that your son was intrusted with no commission from Sir Henry Clinton, and that the visit to you was not merely a cloak to other designs?"

"How can I know it?" said Mr. Wharton, in alarm; "would Sir Henry intrust me with such a business?"

"Know you anything of this pass?" exhibiting the paper that Dunwoodie had retained when Wharton was taken.

"Nothing — upon my honour, nothing," cried the father, shrinking from the paper as from contagion.

"On your oath?"

"Nothing."

"Have you any other testimony? — this does not avail you, Captain Wharton. You have been taken in a situation where your life is forfeited: the labour of proving your innocence rests with yourself. Take time to reflect and be cool."

There was a frightful calmness in the manner of this judge that appalled the prisoner. In the sympathy of Colonel Singleton he could easily lose sight of his danger; but the obdurate and collected air of the others was ominous of his fate. He continued silent, casting imploring glances towards his friend. Dunwoodie understood the appeal and offered himself as a witness. He was sworn, and desired to relate what he knew. His statement did not materially alter the case, and Dunwoodie felt that it could not. To him personally but little was known, and that little rather militated against the safety of Henry than otherwise. His account was listened to in silence.

"Still you think that the prisoner had no other object than what he has avowed?" said the president, when he had ended.

"None other, I will pledge my life," cried the major with fervour.

"Will you swear it?" asked the immovable judge.

"How can I? God alone can tell the heart; but I have known this gentleman from a boy; deceit never formed part of his character. He is above it."

"You say that he escaped, and was retaken in open arms?" said the president.

"He was; nay, he received a wound in the combat. You see he yet moves his arm with difficulty. Would he, think you, sir, have trusted himself where he could fall again into our hands, unless conscious of innocence?"

"Would André have deserted a field of battle, Major Dunwoodie, had he encountered such an event, near Tarrytown?" asked his deliberate examiner. "Is it not natural to youth to seek glory?"

"Do you call this glory?" exclaimed the major, "an ignominious death, and a tarnished name."

"Major Dunwoodie," returned the other still with inveterate gravity, "you have acted nobly; your duty has been arduous and severe, but it has been faithfully and honourably discharged; ours must not be less so."

. . . . . .

One of the judges placed in his hand a written sentence, that he had prepared while the colonel was engaged with Frances, and declared it to be the opinion of himself and his companion.

It briefly stated that Henry Wharton had been detected in passing the lines of the American army as a spy, and in disguise. That thereby, according to the laws of war, he was liable to suffer death, and that this court adjudged him to the penalty; recommending him to be executed by hanging, before nine o'clock on the following morning.

It was not usual to inflict capital punishments, even on the enemy, without referring the case to the commander-in-chief, for his approbation; or, in his absence, to the officer commanding for the time being. But as Washington held his headquarters at New-Windsor, on the Western bank of the Hudson, sufficient time was yet before them to receive his answer.

"This is short notice," said the veteran, holding the pen in his hand, in a suspense that had no object; "not a day to fit one so young for heaven?"

"The royal officers gave Hale but an hour," returned his comrade; "we have granted the usual time. But Washington has the power to extend it, or to pardon."

"Then to Washington will I go," cried the colonel, returning the paper with his signature; "and if the services of an old man like me, or that brave boy of mine, entitle me to his ear, I will yet save the youth."

THE COMMON MALLOW

This plant is called rags-and-tatters, but that is not at all a fair name, for the pale purple flowers are very showy, and, except where they have been riddled by snails and caterpillars, the leaves are quite attractive.

THE CORNFLOWER

This flower is also called the blue-bottle. A lotion used to be made from the flowers to strengthen the eyes, and the French call the flowers break-spectacles, meaning that, after using the lotion, glasses are no longer needed.

THE CHRISTMAS ROSE

This is one of the garden flowers rarely seen on this side of the water, and is not a rose. Its root is called black hellebore, and although acridly poisonous, has been used as a medicine. It has the habit of blooming very early in the spring, and even in freezing weather.

THE VIPER'S BUGLOSS

This handsome plant, with its red and blue flowers, was supposed to offer protection against a viper's bite. The word bugloss means an ox's tongue, and refers to the shape of the leaves. The flowers are very rich in honey, and are much visited by bees and other insects.

PLANTS OF TWO WORLDS

CONTINUED FROM 4193

THERE are a number of flowers that have been introduced into America in much the same way as those we have called weeds, and there are others that grow naturally in both the Old and the New Worlds.

THE WALL-PEPPER

In the first group, we find the wall-pepper, which spreads its stem, crowded thick with scale-like succulent leaves, in great mats, over stones and dusty waysides. Probably we are well acquainted with it as a rockery flower in gardens; here it is quite wild and very abundant, its wide-spreading, fine petals looking like golden stars on green cushions. All the stonecrop family have thick leaves, in which they store up moisture to enable them to grow in the hot, dry, stony places where they are mostly found.

THE WOOD-SORREL

The delicate wood-sorrel grows in cold woods throughout the northern hemisphere. Its knotted, slender, crimson stems run through the leaf-mould, and put out their large trefoils, that look like pale clover-leaves. Above them rise the thin stalks that support a single flower of purest white, streaked with the finest line of purple to show where the nectar is to be found at the base of the petals. There are ten stamens, and the single pistil has five stigmas. The seed-vessel has five ridges, which split when the seeds are ripe, and they are shot out to a distance of a yard or more. Before the seeds are ripe, the plant keeps the seed-vessel hidden under its leaves; but afterward the stalk stands upright to raise the seed-vessel well above the leaves, so that when the seeds are fired out, so to speak, they may land far away. The wood-sorrel, like some violets, has two kinds of flowers, — one kind is that which we have just described, and the other has little greenish, bud-like affairs borne on recurved stalks at the base of the plant. They have no means of attracting insects, pollinating their own stigmas, and nevertheless are sure to develop useful seeds. If insects visit the gay flowers above, well and good, but if not these cleistogamous (as they are called) inconspicuous flowers will ripen fruit. The three heart-shaped leaflets drop in the sunshine.

THE HERB-ROBERT

In the very closely allied geranium family we find the soft, hairy herb-robert, in our country often perched on damp rocks and banks. It has much-divided leaves, more or less reddened (and sometimes entirely red), which have an unpleasant smell when passed through the hands. This has led to its being called in some parts of England by the equally unpleasant name of "stinking Bob." It has pale, magenta flowers with fine lines, or "honey-guides," of red on its petals. Its stems are red, also, and its joints, where the leaves are attached, are swollen. It flowers all summer. The seed-vessels have a long column or beak with a circle of five one-seeded pockets at its base. By a process of unequal drying when the seeds are ripe, the coverings of these cavities, which are prolonged into long tails reaching to the apex of the beak, are suddenly jerked up and curled in rolls at the tip of the fruit, and the seeds therein are sent flying away. It is done so quickly, when one touches a thoroughly ripe capsule, that it makes a person jump. And this is the habit of all the geraniums.

Plants which are found along railroad tracks and about seaports, the seeds of which have slipped out of grain-bearing freight-cars, or during the process of

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THE FOOL'S PARSLEY

This plant is poisonous, and because people have often gathered it under the impression that it was parsley, and have died through eating it, the popular name of fool's parsley was given to it. It has an evil smell.

THE COMMON BUGLE

The common bugle does not look a very attractive plant in the wood or by the roadside, where it creeps along, sending up flowering stems a foot high, with flowers that are usually deep blue but sometimes white.

THE WOODY NIGHTSHADE

The woody nightshade, or bittersweet, a familiar object of our hedges, belongs to the potato family. The flowers are purple and yellow, and the leaves vary in shape. The berries are a brilliant scarlet when fully ripened. It grows in thickets, and is dangerous to eat.

THE HARE'S-FOOT TREFOIL

This flower, which is one of the clovers, gets its popular name from a supposed resemblance of its soft, hairy blossoms to a hare's foot. It grows in dry fields, and its numerous flowers are pinky white in colour and delicate in appearance. The plant grows about a foot high.

THE BITING STONECROP

When this plant is in blossom, its bright golden stars present a very attractive sight. Its leaves have a sharp, biting taste, which has given the plant its name.

THE BIRD'S-FOOT TREFOIL

This is one of the pea family, and the bright little flowers are succeeded by pods which spread out and suggest a bird's foot. The plant is used for fodder.

THE GERMANDER SPEEDWELL

This has various names, such as birdseye, and catseye, and it is often called forget-me-not, although the real forget-me-not is another flower—the myosotis. The germander speedwell used to be considered very unlucky.

THE TUFTED VETCH

This is one of the most ornamental of native wild flowers, its rich purple flowers adding a delightful touch of colour wherever it grows. When the flower withers, the seed-vessel grows into a pea-pod with a curly tail.

unloading grain from ships; or have, perhaps, been brought in the ballast of the ships, are often called ballast plants. They are generally inoffensive, and are regarded as fugitives, as it were, from foreign countries. Occasionally, however, they become weeds.

THE VIPER'S BUGLOSS

There is a stretch of railroad track along the Hudson River that is gay with the viper's bugloss, a bristly ballast plant with oblong and lance-shaped leaves and a straight stem three feet high. From the upper part of this stem short, curved side-branches are given off, which bear crowded flower-sprays. These flowers, before they fully open, are often purplish-red in colour, but when they expand they turn to a most brilliant red. In Canada and elsewhere it is called blue-weed, and is a troublesome plant in rocky pastures. The quartette of little nutlets that each plant contains are scattered broadcast as the dead plants are blown over the country. The scarlet stamens, and the style, jutting well out from the flower, form a platform for insects, by means of which they both deposit and take away pollen carried on the under surface of their bodies. The blue-weed, in spite of its coarseness, is a very close relative of the delicate forget-me-not and heliotrope, all alike belonging to the borage family.

BIRD'S-FOOT TREFOIL

The bird's-foot trefoil with pale yellow flowers that is common in every field of England, here appears only as a ballast plant. It belongs to the pea family and has some odd habits. It is one of the plants that sleep at night, each one of the triple leaflets hanging straight down from the tip of the leaf-stalk after sundown. The wings are folded over the keel, so as to form a kind of cushion for a honey-seeking insect, and as it settles down astride their saddle a little, worm-like thread of paste appears at the tip of the keel and sticks to the bee's under-surface. This is pollen. The club-shaped anthers form a sort of partition between the main cavity of the keel and a small one at its very tip. This latter space is filled with pollen by the anthers, the longest style projecting into the mass. Pressure on top of the keel forces the stamens and the style upward and forward so that they push the pollen out through a small hole at the tip, exactly as the plunger of a pump forces water out of its spout. If the keel be pressed, the style itself is pushed out, and is likely to take up some pollen from the visitor's coat.

THE STONE-CLOVER

In the pea-flowered family we also find the old-field or stone-clover, whose fluffy heads of flowers are supposed to resemble the foot of a tiny hare. It does not look much like a clover at first sight, for its trefoil leaves have very slender leaflets and its calyx teeth are so much longer than the petals that they give the flower-head the appearance of a soft brush, amid which the tiny pink petals are almost hidden. It has become very thoroughly naturalised, but is useless for fodder.

THE TUFTED VETCH

The tufted vetch, another pea, is just as much a native of America as it is of Europe or Asia. Its weak stems thrust out dense, one-sided sprays of bright blue drooping flowers, that, like those of the hare's-foot clover, are fertilised by means of the pressure exerted on the keel. It is a persistent perennial, difficult to get out of old meadows, but as its foliage with many leaflets affords a good fodder (whence, perhaps, its name of cow-vetch) this does not so much matter.

FOOL'S PARSLEY

In the carrot family, which contains many poisonous plants, very easily mistaken for harmless ones, we have the fool's parsley, which, although originally brought from Europe, has become sufficiently at home in waste places to be guarded against. It is a slender-stemmed herb, with delicate, shiny, much-divided leaves, known as fool's parsley because no wise person would be likely to mistake its uncurled leaves for those of the true parsley. It grows to about two feet in height and bears umbels of tiny white flowers. From the base of each umbel hang down from three to five slender green points, or bracteoles. This should be remem-

bered as an especial point by which to recognise this poisonous plant. Its seeds that are not to be tasted, are in pairs forming nearly spherical strongly-ribbed, shining fruits.

BITTER-SWEET

Another one of the poisonous plants that we find depicted here, is the woody night-shade, or bitter-sweet, a member of the potato family, which has made itself thoroughly at home in our thickets, and climbs in a half-hearted manner over shrubs, or merely straggles along the ground. It has rather unusual leaves, ovate or hastate in general outline, but three-lobed or divided, the apical lobe being the largest. It has a typical potato blossom, in cymes, star-like, with yellow stamens projecting like a beak, but usually the flower is dull purple. The berries succeeding the summer blossoms are among our most striking fruits, as they are fleshy and egg-shaped and when fully ripe are a brilliant scarlet; but in one cluster we may find green or yellow, as well as red berries. It is a dangerous plant to eat.

THE SETTERWORT

In Great Britain they have also the early flowering, stinking hellebore, or setterwort, that is also a hellebore, both of them belonging to the buttercup family. As in some other members of this family, the showiness of the flowers is due to the large sepals. The setterwort's leaves are large and handsome, and are divided into a number of leathery, slender leaflets, which spread out from the top of the leaf-stalk like the outstretched fingers of our hands. They are dark green, and retain their colour and freshness throughout the winter; but in the new year the stem makes a sudden growth and puts forth oval, leafy bracts and large, drooping flowers. We should scarcely find the true petals unless we knew where to look for them, for they have been turned into little green two-lipped tubes that are filled with nectar, and these are hidden at the bottom of the flower beneath the many stamens that stand crowded around the two or three pistils. The flower opens slightly, when the curved stigmas overtop the unripe stamens and receive pollen brought by any early bees or flies, which have to crawl over them and into the flower to reach the nectar. Later the stamens spread out more, the outer sepals get a line of purple along their edges, and the anthers shed their pollen. When this is all gone the stamens drop off, and the pistils grow into seed-pouches that open at the top, something like those of the columbine.

SWEET MARJORAM

Another garden plant which we know well is the sweet marjoram, a mint that in its native land covers wide stretches of downland. Its perennial underground rootstock sends out runners all round, so that we always find it in masses. The branching, square stems grow to about three feet in height, and are clothed with oval leaves that end in clusters of purple flowers. These are of two sizes, the larger dark purple ones having both stamens and pistil, while the smaller and paler ones have only a pistil. The yellow-dotted calyx is almost hidden by the larger purple bracts. Beginning to flower in July, they keep up a continuous display well into the autumn.

BACHELOR'S BUTTON

Another common garden flower is that composite of many names, such as bachelor's button, bluebottle and cornflower, but Americans must always remember that corn to the Englishman does not mean maize, or Indian corn, but grain, especially wheat. The round base of the flower-head, covered or protected by broad scales, somewhat suggests a thistle but it has very conspicuous rays. The inner flowers are purple and tubular, but the outer florets are like trumpets with jagged brims. The flowerets in the cornflower have divided their duties. The brilliant azure of the large flaring flowers on the outer circle of the flowering heads serves only to attract insects, for they are without pistil or anthers. The fruitful ones are the insignificant purplish ones within the centre. These have both pistil and stamens, the latter united into a ring about the flower, poised on slender filaments. They exude pollen until the tube of the flower is quite filled, for the attraction of insects.

THE HERB-ROBERT

The dainty little herb-robert, with its delicate pink flowers and its crimson leaves, is a wild geranium. In some parts children call it by the name of kiss-me-quick.

THE STINGING-NETTLE

We all avoid the stinging-nettle, although if the leaf be grasped quickly and firmly it gives no pain. The flowers are smaller than those of the dead-nettles.

THE RED DEAD-NETTLE

This flower is no relation of the stinging-nettle, although the leaves of both are very much alike. The name dead-nettle was given because its foliage has no stinging power. This flower is also called archangel.

THE WHITE DEAD-NETTLE

This flower is very much like the red dead-nettle, but is larger in all its parts. It is stingless, and blossoms from spring to autumn. The dead-nettle is not eaten by animals when it is with the stinging nettle.

THE SWEET MARJORAM

This is one of our kitchen herbs, and an oil from it is used to cure toothache. The plant is very fragrant, and the light purple flowers growing in thick clusters at the ends of the stalks add a charm to the downlands.

THE GROUND-IVY

The ground-ivy, which is one of our earliest spring flowers, is no relation to the real ivy. It used to be called ale-hoof, and was much used in brewing. It is also called Gill-run-over-the-ground.

THE GUELDER ROSE

This flower belongs to the honeysuckle family, to which the elder-tree also belongs; in fact, another name for the guelder rose is the water-elder. It is also called the May rose and the tisty-tosty. The flowers are snow-white,

THE WOOD SORREL

The charming little wood sorrel, with its white flowers streaked with pink, is often called the hallelujah, because it blossoms at Easter. The wood sorrel is thought by some to be the original shamrock of St. Patrick.

THE STINGING-NETTLE

Many a child, whose bare limbs are scarlet and prickling, rues the day when the stinging-nettle first extended its travels from the Old World to the New. It does not in the least interest that child, at that moment, to know that hemp-fibres, woven into the ropes he plays with, have been extracted from a plant of the same family. The stings are inflicted by the peculiar weapons borne by the nettle for warding off plant-eating animals. Each hair is expanded at the base and at the top is swollen into a little round cap bent to one side. At this bent portion the walls are very thin, and the head is broken off at the slightest touch, leaving a sharp point that penetrates the skin, and by means of which the irritating contents of the hair are forced into the wound. Oddly enough an acid possessed by ants, and which helps to make a bite of that insect burn, is present in these nettle-hairs. These hairs irritate the membranes of the mouth and nose of browsing beasts, and they carefully avoid the plant.

Among the nettles may grow the dead-nettles that are members of the mint family and therefore are not nettles at all, but have been so called because the leaves of the white ones are very much like those of the stinging-nettle. As these do not sting they are called dead-nettles, or in some places dumb-nettles.

WHITE DEAD-NETTLE

Most frequently we shall find the white dead-nettle growing against, or among, a clump of stinging-nettles, and then we shall notice how much the leaves of the two plants are alike. The dumb animals, dreading lest they be stung by the real nettles, and evidently observant of the general appearance of a nettle-plant, carefully avoid all other plants of like appearance. Consequently the dead-nettle is left uneaten and is able to ripen its seeds in safety, especially when in company with the stinging-nettles. This is a form of self-defence obtained by a likeness to a dangerous plant — protective mimicry it is called.

GROUND-IVY

The ground-ivy, another scentless mint, has earned for itself the name of Gill-run-over-the-ground; a kind of name that reminds one of Creeping Jenny or Wandering Jew. These names have been earned by the plant's habit of travelling over the ground by means of long runners. We often see the ground-ivy along damp banks, or in shady thickets, as it creeps under the hedgerows of England whence it came, forming carpets of furry, nearly-round and evenly-toothed foliage, and holding up little clusters of blue-purple flowers very early in spring. It also has smaller flowers containing only a pistil.

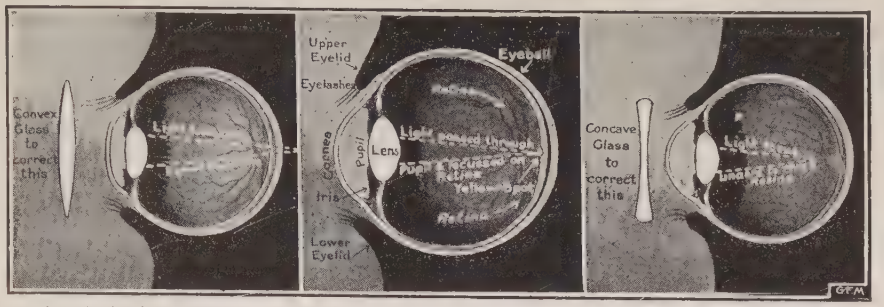
THE GERMANDER SPEEDWELL

Upon sunny banks in early summer we are sure to find the germander speedwell, or bird's-eye. We can tell this plant quite easily because of its annoying habit of dropping its flowers as soon as a spray is picked. The bright blue blossoms in the axils of the upper of the sessile leaves, have a short tube to the corolla. Of the four lobes that represent the petals, only two are of the same size. They are all marked with fine lines of darker blue, leading to the mouth of the tube, and to make this clearer to the flies that carry the pollen, each is margined with white. Insects grasp with their front legs the outstanding stamens as if they were perches, and the stamens bend both downwards and inwards, and smear pollen upon the visitors.

THE GUELDER ROSE

Last of all, we will mention the charming guelder rose, from which so many of our snow-balls in the garden are descended. It is native not only to Europe and Asia but to northern America, and, like the cornflower, attracts attention to its fruit-bearing treasures by the circle of gay, but otherwise useless flowers. By gradually increasing the number of these snowy, sterile florets, the florists have built up the white globes that are so familiar in old-fashioned gardens. The glowing, sour, scarlet fruit of this tall shrub has caused the New Englander to call it the cranberry-tree. The leaves are broadly ovate in pairs.

CONTINUED ON PAGE 4417.



In the middle picture we see a section of a perfect eye, with the light focussed correctly on the retina. The left-hand picture shows an eye in which the cornea is too flat, and the light being focussed beyond the retina causes indistinct vision. The eye on the right hand has the cornea too convex.

THE PARTS OF THE EYE

CONTINUED FROM 4218

WHEN we examine the eye, the first thing we notice is that the front of it is transparent. This round, transparent part in front is called the *cornea*, which really means the horny thing. If we look very carefully at it, we shall see that it bulges forward somewhat. The curve of it is not quite the same as the general curve of the eyeball. This shape of the cornea is very important because of its effect on the rays of light that enter it. It acts just like the curved surface of the eye-cell of a leaf.

The first and greatest business of the cornea is to be perfectly transparent. It contains, therefore, no blood-vessels, small or great; it would not do to have red or white blood-cells in the cornea interfering with the passage of light. But the cornea is alive and must be fed, and it is supplied by materials that pass to it through the walls of the tiny blood-vessels that we find all round its edge. The cornea is well supplied with nerves, nearly all of which run to its front surface, in order that it shall be very sensitive.

This is necessary so that the least speck of dust, or anything else that would injure it, shall be felt and wiped away by the eyelids and the tears. Only too often, however, a workman gets what he calls a "fire" in his eye, and then there is a great risk that, when the cornea recovers from the injury, the injured place will be opaque for the rest of his days. Also, when anything of this kind happens to the cornea, blood-vessels grow into it from the side. They must do so, for they must supply food and other materials to the injured part, if it is to recover; but these blood-vessels mean that the passage of light is interfered with.

Only a few months ago, the first attempt that has ever succeeded was made to remove a piece of cornea that had become opaque, and to graft there a piece of healthy transparent cornea. It is well for us to understand how important and wonderful this part of the eye is. All the light we see by must pass through it; yet it is a living thing, with all the needs and delicacy of a living thing—very different from a curved piece of glass. Lastly, it is very much exposed, though, as we know, the eyelid, eyelashes, eyebrow, and the bony wall around the eye do their best to protect it.

All round its edge the cornea passes into the white, thick, strong coat of the eyeball; indeed, the cornea is really a special part of this strong outer coat of the eyeball that has been made transparent, and has been made to bulge forward a little in order to help in focussing the light.

The white outer coat of the eyeball is very strong, and will stand a good deal of pressure. If we feel one of our own eyes with the finger, we shall find that it is quite tight; and the existence of this pressure in the eyeball, which is supported by the outer coat, is of great importance for good seeing.

Now, when we look at anyone's eye, we see something through the transparent cornea. We see a round, coloured ring with a black hole, small or large, in the middle of it. The coloured part is called the *iris*, and it is a ring of muscle with a hole in the middle of it, which is the pupil. This looks black because it is really the hole leading into the dark chamber, or inside of the eye, which is like the inside of a camera. Now, if we could be shown an eye cut through sideways, we should see that there is quite a large space between the cornea and the front of the iris. This space is filled with a watery fluid, and the light has to pass through this fluid before it is able to reach the pupil.

THE PUPIL OF THE EYE THAT GETS BRIGHT IN A DIM LIGHT

The business of the iris is to regulate the size of the pupil. The less the amount of light, the larger must the pupil be; and the more the light, the smaller the pupil. So when a person goes from darkness into light, or when the eyes are opened in a bright light, anyone may see that the pupil gets smaller. We can also notice that the pupil gets smaller if a person who has been looking at something far away suddenly looks at something close to his eye. There is a special reason, rather difficult to explain, why it improves the clearness of vision to reduce the size of the pupil when looking at something near. The cause is to be found in the shape of what lies behind the pupil, as we shall soon see.

All the colour of the eye is due to the iris. The colour is not to be found at all in the muscle fibres that make the iris; they are just like other muscle fibres, and are the same in everybody. But both on the back and front of the iris there is a layer of cells, which may or may not contain a certain amount of pigment, or paint. It is this that varies in different people. It is interesting from the point of view of beauty, because its variations in different people provide many different types of beautiful eyes. But the colour of the iris has quite lately become most interesting, because we are just beginning to learn what are the rules as to the way in which eye-colour descends from parent to child. This is one of the subjects which is being closely studied by scientific men all over the world, and we are no doubt going to learn a great deal from it.

THE PEOPLE WITH BLUE EYES AND THE PEOPLE WITH BROWN EYES

It seems that some eyes have brown pigment in the cells on the front of the iris, and others have not. This gives us at once two great types of eyes—those which have the brown pigment on the front being more or less brown, and those which have not being more or less blue. There is far more to say than this, of course, because, as everyone knows, there are many different blues and browns, and many eyes which could not be called either. But still we have already learnt that a father and mother with genuine blue eyes never have brown-eyed children; on the other hand, if one parent has brown eyes and the other parent has blue eyes, most of the children, at any rate, will have brown eyes.

At present, in America, it seems quite plain that blue eyes are rapidly becoming rarer and brown eyes commoner. One of the deeply interesting questions is as to why this is so, and what the consequences will be. Careful study of the iris in thousands of people in all parts of the country, and especially the study of the eyes of children as compared with their parents, will teach us not only a great deal about heredity, as it is called, but will also help us to learn what is really happening, and how far it is true that the blue-eyed strain in the population is dying out and the brown-eyed people surviving.

THE PEOPLE WITH BLUE EYES WHO ARE DISAPPEARING FROM THE WORLD

It is very likely that though the blue-eyed seem less able to bear city life, and the conditions of existence nowadays, they may yet have many valuable qualities, and their slow disappearance threatens to be a great loss to the world, and ought to be thoroughly investigated, and some means found to check it.

Now, if we pass through the door in the iris, we find a beautiful transparent thing called the *lens* of the eye. It is a genuine lens, just like the lens of an ordinary magnifying glass, and it is of the same shape, convex on both sides. It helps to bend the rays of light entering the eye, just as the cornea did, and it is perfectly transparent. Unlike any lens that any man ever made, this lens, while able to do all that artificial lenses do, can do far more; for it is elastic, and can change its shape as we please.

How the lens of the eye is kept inside a little bag

The lens lies inside a little bag, and that bag has little fibres attached to it all round, which can be pulled upon by tiny slips of muscle inside the eye. When the bag is pulled upon in this way all round, the lens inside it is made flatter. When the muscles stop acting and the pulling ceases, the lens is free to bulge out again if it is perfectly elastic.

It is by this power of the lens that we are enabled to see clearly both at short distances and at long distances. Now, as everyone knows, in the case of an ordinary camera, it is equally necessary to focus the light properly if the picture to be taken is to be sharply defined on the plate; or if we are using a magic lantern, we know that we must focus properly if the picture is to be sharply thrown on the screen. In these cases, and in all other cases where men use artificial lenses—as, for instance, in the microscope and the telescope—the same method of focussing is employed, and that is to alter the distance of the lens, or lenses—for there may be several—from the place where we want the image to fall.

How our eyes focus by changing the shape of their lenses

It is very interesting to discover that in the fishes this method, which men employ in all their instruments, is employed in the eye: the lens has its position shifted nearer to or farther from the *retina*, or screen, at the back of the eye. But in all the higher types of eye, such as our own, this method is not employed. There is no arrangement for shifting the lens backwards and forwards in order to suit the distance of the particular thing we are looking at. Its distance from the retina is fixed. The method of the higher types of eye is not to alter its position, but to change its shape where it stands. That is why it has to be most perfectly elastic, so that after it has been flattened, by having the bag in which it lies pulled upon, it can spring back perfectly to its rounder shape.

This means that the shape of the eyeball, as a whole, is very important. An eyeball may be long from back to front, and then the lens is far from the retina, or it may be short from back to front, and then the lens is nearer the retina. If the lens be of the same shape in the two cases, one eye or both must certainly not be quite suited to its purpose. Thus, in consequence of the varying shapes of eyeballs, the variations in the curve of the cornea, and the variations in the shape of the lens itself, we find that there are a very large number of people whose eyes are not perfectly suited for all kinds of use.

Short-sightedness has nothing to do with the health of the eye

Nothing is more important than for us to understand, at the very first, that this is not at all a question of the health of the eye. An eye may be healthy or ill, like any other part of the body, but what we are now talking about is simply a question of the mere shape of the eye or certain parts of it. The bending of rays of light is called *refraction*, and so we usually speak of "errors of refraction" to describe those cases where an eye is short-sighted or long-sighted, or has some defect of that kind.

This has nothing to do with the health of the eye or of any other part of the body, except that, as we shall see, if something is not done, the rest of the body may be affected. We are to look upon the eye for the moment as a kind of optical instrument or machine, and simply to realise that the shape of this optical instrument will affect the rays of light that pass through it, just as in the case of any other optical instrument.

It is very commonly found that the cornea is not quite regularly curved; it bulges more or less in one direction, say, from side to side, than it does in another direction, say, from top to bottom. This means that, if we are looking at a cross, the one limb of it cannot be seen sharply if the other is. As a rule, this defect in the shape of the cornea is so slight that

it is not worth bothering about; but often it is worth while to wear glasses which are more curved in one direction than in another—more curved in the direction in which the cornea is less curved, and less curved where the cornea is more curved—so that the little defect is corrected. This particular error of refraction is not nearly so important as those we must now study.

WHY IT IS THAT SOME PEOPLE BECOME SHORT-SIGHTED

Short-sightedness is what happens when the eyeball is rather too long from back to front. This error of refraction means that the light is focussed before it reaches the retina, and when it does reach the retina the picture it makes is rather blurred. Sometimes, also, short-sightedness may be due to the cornea being too much curved, so that it acts as too strong a lens, and the rays of light are focussed too soon.

Short-sightedness is a very common defect, and is very inconvenient. We can see anything near quite well; the things farther off are blurred. The reason why we see things clearly when they are quite near, and why we therefore always hold a book close to our eyes, is that, when a thing is held close, the eye catches the light rays from it as they are spreading out.

If they are spreading out when they reach the eye, they are not so likely to be focussed too soon; but if the thing is farther away, then the rays coming to it from the eye are not spreading out, or divergent, as we say, but are parallel, and will be too easily focussed for the convenience of an eye that is too long from back to front.

THE NUISANCE OF BEING SHORT-SIGHTED WHEN PLAYING GAMES

The short-sighted person is at a disadvantage in recognising people, and also in playing games. It is a nuisance to have to wear glasses to see clearly at any distance; but, on the other hand, he suffers no injury if he wears no glasses, and his eyes are very well suited for work at short distances, such as reading and writing, looking after machinery, sewing, and, indeed, nine-tenths of all the work that is done by civilised people to-day. People who start short-sighted when they are quite young, or who even are long-sighted at first—as most young children are—often become gradually more and more short-sighted until the age of, perhaps, thirty. Most of the people who study this subject are very sure what the cause of this is, only, unfortunately, they do not agree with each other.

Some of them who have not really gone into it properly think that the short-sightedness is a sort of disease of the eye, and is due to over-use of it, bad conditions during childhood, and so forth. Others think that it is a natural change which is bound to happen in any case; and still other people suppose that this increase in short-sightedness is due to the constant use of the eye at short distances.

The truth lies somewhere between the last two opinions; each of them is probably true in part. The eye, like other parts of the body, does undergo natural changes during life, and as it gradually becomes more long-sighted after a certain age, quite apart from anything that is done to it, there is no reason why it should not become more short-sighted during the earlier years.

HOW SHORT SIGHT IS CAUSED BY USING THE EYE FOR SHORT DISTANCES

On the other hand, we can prove that, when the eye is used for short distances, certain muscles inside it are used in such a way as to tend to make the eyeball longer from back to front, and therefore more short-sighted.

The reason for going carefully into this is that very few people understand the facts, and many doctors even have not properly inquired into them. Young people between the ages of twenty and twenty-five find, very often, that year by year they get rather more short-sighted; perhaps they require to use glasses for games where formerly they did not need them, and the glasses have to be made stronger and stronger; or parents find their children beginning to require glasses for short sight, and every couple of years or so the glasses have to be made stronger.

People are alarmed if they think that all this means a kind of disease of the eye, or if they begin to ask themselves where this is going to stop. That is why everyone should understand that short sight is not a disease at all; that the changes which go on are natural; that they only go on to a certain point.

More than this, it is certain that we may look upon short-sightedness in our time as a kind of adaptation to our needs—that is to say, in the case of the great majority of people who have to use their eyes at short distances. For such distances the short-sighted eye is just the best that one can have; it lasts splendidly, and does not tire.

SHORT-SIGHTED PEOPLE MAY BECOME LONG-SIGHTED AS THEY GROW OLD

After a certain age, perhaps about forty-five, or later, the eyes, after having remained just as they were for many years, begin slowly to become long-sighted, or less short-sighted, as the case may be. But before we look at this we must return to the case of the child.

Practically all very young children are long-sighted. A certain number of them remain long-sighted as the years go on, and are still long-sighted when they begin to learn to read and write. There is no more disease or ill-health here than there is in the other case, but simply the eyeball is too short from back to front, the cornea is too flat, and so the rays of light are not focussed sharply in time, and reach the retina sooner than they should. The retina is too near the lens.

Now, in days that are gone this was no serious matter, because people lived far more natural lives than they do now; perhaps we should say far more animal lives than they do now; but that is a difficult question. Anyhow, they lived much more in the open air. Instead of constantly reading books at a few inches distance, they had to read the book of the distant clouds and mountains; they had to see animals or enemies at great distances, and the use of their eyes for short distances was only occasional.

THE DIFFERENT USES FOR WHICH NATURE HAS FITTED DIFFERENT EYES

When the eye is to be used at long distances, evidently the long-sighted eye has little to complain of. It is as well off as the short-sighted eye is in the kind of life that most of us are living nowadays.

The time may yet come when, before we decide what to make of our children, we may care to ask ourselves the question: What has Nature made them for? Perhaps, for instance, other things being equal, we should think twice before we sent the long-sighted boy to a desk rather than to sea or to Europe. Meanwhile, however, our general idea is that all children are just the same, and require just the same treatment, and the long-sighted child is treated just like the other. But, whatever we do in this way, it is certainly our business to see that we do not hurt him in the process. We do hurt him, and it is easy to show why.

The long-sighted eye, we have said, is too short from back to front. The rays of light are not focussed in time. Now, if such an eye is to be used at short distances, it will be very much strained, because the muscles inside the eye will constantly be trying to change the shape of the lens in order to make the eye focus better; in fact, the long-sighted eye requires to use the muscles inside it in all circumstances. This means that it is liable to get tired, and every long-sighted person knows what it is to get headache and eye-strain from the use of the eyes under conditions which would not be at all inconvenient or disturbing to a short-sighted person.

THE FOOLISHNESS OF MAKING CHILDREN USE THEIR EYES IN A WRONG WAY

In our ignorance and carelessness regarding children, and in the very foolish way that we pretend to educate them, we at present inflict very grave cruelty, and perhaps often injury that is never recovered from, upon large numbers of children everywhere by compelling them to use long-sighted eyes for purposes to which they are not suited.

All over the country, children are straining their eyes at reading and writing, gaining no good, but only harm, from what we do for them, and all they need is a pair of spectacles with rounded convex lenses that will help to focus the rays of light quickly, so that they are brought sharply together by the time they reach the retina at the back of these short eyes. It is the short eye, we must notice, that is long-sighted, and it is the long eye that is short-sighted.

It is just beginning to be discovered how important this subject is, and, now that it is slowly occurring to us that before we start schooling a child we must make it fit to be schooled,

we may hope that, within a very few years from now, no long-sighted child will be allowed to be injured for the lack of spectacles costing a few dollars. The relief obtained when proper glasses are employed is quite astonishing.

As we shall readily understand, it is concave lenses that are used in spectacles for the short-sighted eye, and convex lenses that are used in spectacles for the long-sighted eye. We may think this out for ourselves.

As people become elderly the eye becomes more long-sighted; this change oftenest occurs at some time after forty-five. If the person was short-sighted, he now becomes less so. Indeed, if we take the whole course of life, there can be no doubt that, under ordinary modern conditions, the short-sighted person is much better off than the long-sighted person, although at first it may not appear to be the case.

THE LENS OF THE EYE THAT CEASES TO BE ELASTIC AND CAUSES LONG SIGHT

The long-sightedness of elderly people is due to changes that occur mainly in the lens of the eye. The all-important elasticity of the lens becomes impaired, and it does not bulge, when the pressure of its coat is removed, as readily as it used to do; indeed, it becomes decidedly flatter. In extreme old age the lens loses its elasticity to such an extent that its shape cannot be changed at all.

The commonest sign that the eyes are beginning to show this change is that the person finds it more difficult to read in a dim light. It is very much better to be sensible about this and wear glasses than to try to fight against it. This does no good, and, on the other hand, it may do just the same kind of harm as is done to the long-sighted child that is "educated," as we call it, without having glasses provided for him. The same is true in this case, as we have already seen, that people suppose the need for glasses to be a sign of weakness or disease, and so they think they ought to fight against it.

Now, it is good to fight against weaknesses, and there is not much hope for people who do not; but, if we understand the facts, the weakness is in being too proud to wear glasses or too careless. Of all the many evils from which mankind suffers, there are very few more unnecessary, more easily and cheaply relieved, than those due to errors of refraction in the eye, which we have just been briefly studying.

WHY MANY GREAT MEN OF THE PAST BECAME BLIND

In old age, or sometimes before it, the lens of the eye may become opaque. Much the commonest form of this misfortune is found in old age, but there is also a very definite form which may occur in quite young people, and which is known to appear in a regular way in parents and children. *Cataract* is the name applied to opaqueness of the lens. Its consequence is blindness. The time was, and that quite recently, when there was no remedy for this terrible affliction.

We know that many of the very great men of the past became blind in their old age, and in many cases it was cataract that was the cause. Nowadays science triumphs over this calamity. Thanks to those who have studied the structure of the eye, and thanks to Pasteur and Lord Lister, who have taught us how to keep microbes away from wounds, so that they shall heal easily and painlessly and certainly, it is now possible simply to make a little cut in the eye, then a little cut in the coat of the lens, and then, by a little squeeze, to push the lens out through the cut which was made—and there it lies in the surgeon's hand, looking almost like a little lens of ground glass.

This would probably have to be done to both eyes, though it makes all the difference in the world if it were done to only one eye when both were affected. It is easily done, without pain. The obstacle to the light is now gone, and the light can pour through to the retina; but the rays are not focussed, and things cannot be properly seen.

HOW SCIENCE IS ABLE TO GIVE SIGHT TO THE BLIND

The remedy is to supply the person with spectacles, with strong convex lenses that take the place of the lenses he has lost. Few operations, so simple and so easy and so certain, do so much for old people, and it would be worth while to study the eye, if only to learn how it is possible, by the application of our knowledge, to give sight to the blind in this way, as is done all over the civilised world many times daily.

The next part of this is on page 4401.

A FEW WELL-KNOWN CANADIANS

THROUGH more than three centuries of conflict and doubt, the history of Canada has gradually unfolded itself until to-day we have a nation. The daring of the early pioneers in war and in trade; the courage of the Roman Catholic missionaries; the Frenchmen's loyalty to creed, race and language; the love of liberty of the United Empire Loyalists; these and many other influences have gone to mould Canadian institutions and Canadian character. The man who drew together all these complicated threads into a united whole and who held it true to British loyalty while retaining an independence of its own was John Alexander Macdonald. The man who followed him and who has done so much to weave closer together the two races into a nation distinct by itself is the French-Canadian Wilfrid Laurier. These statesmen may be called the two great fathers of the Dominion.

THE RT. HON. SIR JOHN A. MACDONALD, K. C. B.

John A. Macdonald was born at Glasgow on January 11, 1815. His father, Hugh Macdonald, was a native of Sutherlandshire, but while a young man moved to Glasgow. Having failed in business he migrated in 1820 to Canada and settled in the town of Kingston, Ontario. The father still did not succeed, and moved in succession to two of the small neighbouring settlements, Hay Bay and Stone Mills on the Bay of Quinté. In 1836, the family returned to Kingston, where the father was appointed to a position in the Commercial Bank.

The lad between the age of ten and fifteen attended the Kingston Grammar School. This concluded his school days. "I had no boyhood," he once said to a friend. "From the age of fifteen I began to earn my own living."

On leaving school in 1830, he commenced the study of law in the office of Mr. George Mackenzie. On February 6, 1836, he was called to the bar, immediately opened an office in Kingston, and soon had a good practice.

In the municipal elections of 1843 he was elected alderman, and the same year married his cousin, Miss Isabella Clark. Soon after their marriage Mrs. Macdonald became a confirmed invalid, and until her death in 1858, he was most devoted in his care of her.

In 1844, he was elected to the legislative assembly. For the first few sessions, he took little active part in the discussions of the legislature. He spent his time in making himself familiar with parliamentary forms and in a study of constitutional history. The studious young member soon attracted attention. In May, 1847, he was appointed receiver-general, but a little later the ministry resigned. In the Coalition Ministry of 1854, he was chosen attorney-general, and three years later became Premier of the Province of Canada.

Macdonald was the guiding spirit of the Quebec conference which met in 1864 to discuss confederation. He was chairman of the committee that went to London to arrange the details of the British North America Act, and for his services he was made a Knight Commander of the Bath. While in London he married Miss Bernard, daughter of Thomas Bernard of Jamaica.

After confederation, Sir John was chosen to form a ministry and became the first Premier of the Dominion of Canada. In 1873 he resigned, and in the elections which followed, his party was defeated. With his national policy and the cry of "Canada for the Canadians," he was returned to power in 1878 and remained at the head of the government until his death in 1891.

The election of 1891 was the last great effort of a long political career. The strain of the winter campaign with all its excitement was too much for the aged statesman. While attending a

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meeting at Napanee, Ontario, he took a chill from which he never recovered.

A wreath of white roses on his breast as he lay in his coffin, "From Her Majesty, Queen Victoria, in memory of her faithful and devoted servant," and a patent of nobility conferred upon his widow as the Baroness Macdonald of Earnscliffe, were marks of favour of his sovereign. A memorial service in Westminister Abbey, the first of its kind in honour of a colonist, and a tablet erected soon after his death in the crypt of St. Paul's Cathedral, indicated the sense of national loss felt in the motherland.

Sir John was not an orator. His aim was to carry his point and not to win applause. The plain common sense which stamped his views carried great weight with the people. His ambition was a closer union of the provinces and still closer ties with the motherland.

RT. HON. SIR WILFRID LAURIER, G.C.M.G.

Wilfrid Laurier was born at St. Lin, Quebec, November 20, 1841. His father was a land surveyor. He was educated at L'Assomption College and at McGill University, where, in 1864, he graduated in law. The same year, he was called to the bar. Four years later he married Miss Lafontaine.

In 1871, Wilfrid Laurier was elected to the legislative assembly of Quebec. The morning after his maiden speech, his name was on every lip. Mr. Louis Frechette, the poet, wrote, "Whence has this new orator come? so fluent, cultivated and charming; who awed even his opponents into respect by language so polished, so elevated in tone, so courteous in rebuke and sarcasm and above all so moderate even in the heat of discussion." Henceforth he was known as the silver-tongued Laurier.

In 1874, he was elected to the House of Commons. His fame as an orator preceded him. The galleries were crowded to hear his first speech. He won such a triumph that he was marked for early appointment to the cabinet. In 1876 he was chosen minister of Inland Revenue. When Mr. Blake resigned the leadership of the Reform party in 1887, Laurier was chosen as his successor.

On the defeat of the Conservatives in 1896, he became Premier and held office until the defeat of the Liberal party in 1911. He received the honour of knighthood in 1897.

Sir Wilfrid is tall, rather slender and has a figure most graceful and dignified. In his clean shaven face, dignity and goodness are blended. He loves his nationality and is proud of his French origin, but he is a great admirer of the English institutions.

Laurier is the most eloquent English statesman of to-day. He hits hard but never offends. He is always moderate in action as in words. By his life, words and actions, he has brought the two races together, the English to know and to trust the French, and the French to know and to trust the English, and both to feel the glory and pride of being Canadians.

RT. HON. SIR DONALD SMITH, G.C.M.G., G.C.V.O., ETC., LORD STRATHCONA, AND MOUNT ROYAL

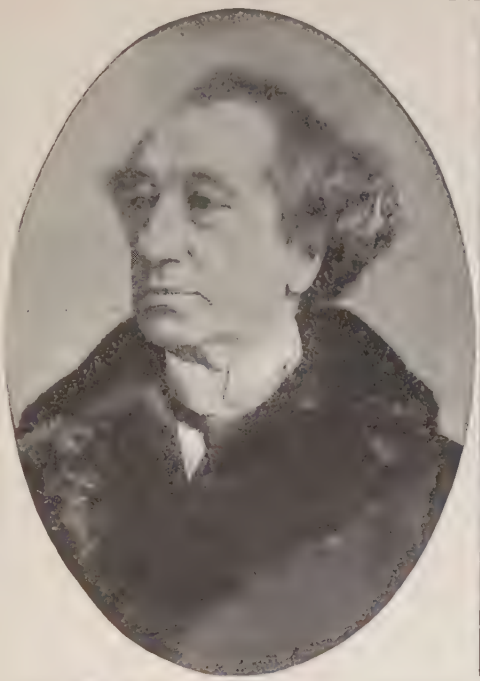
Donald Alexander Smith was born in Morayshire, Scotland, in 1820. He received a common school education and, in 1838, entered the service of the Hudson Bay Company. Thirteen years were spent at trading posts on the coast of Labrador. Promotion followed promotion until he became Governor of the Company.

He was elected to the first legislative assembly of Manitoba and served in that body for four years. For nearly a score of years, he was member of the House of Commons. In 1896 he was appointed High Commissioner for Canada in London.

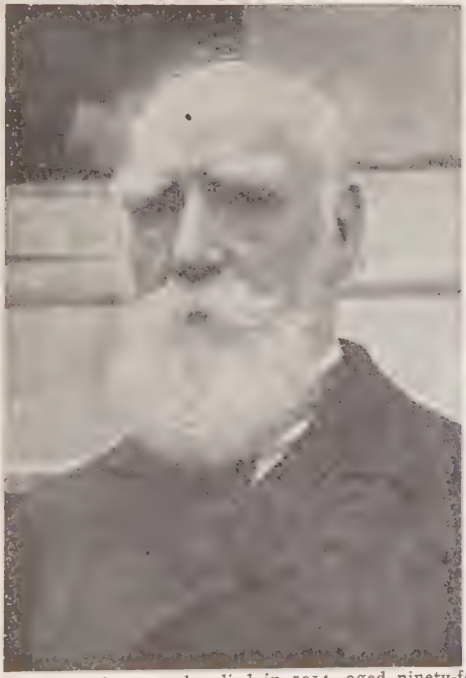
Sir Donald took an active part in the building of the Canadian Pacific Railway and its completion was largely due to his efforts. His financial aid was always ready to promote Canadian interests.

His sovereign soon bestowed upon him many honours. In 1897, he was raised to the peerage as Lord Strathcona and Mount Royal. He also served as Chancellor of McGill and Aberdeen Universities. Nearly a score of colleges in Great Britain, United States and Canada gladly conferred upon him honorary degrees. Until his death in 1914, in spite of his advanced age, this grand old man, hale and hearty,

FOUR FAMOUS CANADIANS



These two Canadian statesmen have had much to do with the development of Canada. Sir John A. Macdonald gave his life to the welfare of his adopted country. Sir Wilfrid Laurier is a Canadian by birth and for sixteen years was the actual head of the government, as the Governor-General sent over from London has little real power.



Lord Strathcona, who died in 1914, aged ninety-four, was even then a strong man and represented Canada in London. Sir Gilbert Parker's novels of Canadian life have attracted attention wherever English is spoken. Though he now lives in England, his heart is still in Canada, and as a member of the British Parliament he can speak for his country.

performed his duties as Canada's representative in London.

SIR GEORGE STEPHEN, BT., G.C.V.O., LORD MOUNTSTEPHEN

George Stephen was born in 1829 in Banffshire and emigrated to Canada in 1850. He soon became interested in many business enterprises. He gave valuable assistance in building the Canadian Pacific Railway and was its president until 1888. In 1886 he was made a baronet and five years later raised to the peerage with the title of Lord Mountstephen.

SIR WILLIAM VAN HORNE, K.C.M.G.

Canada's most active financier is Sir William Van Horne. He was born near Joliet, Illinois, in 1843. At the age of fourteen, he began his railroad career as a telegraph operator. Promotion followed promotion until 1882, when he was called to Canada as General Manager of the Canadian Pacific Railway. Six years later, he was promoted to President. Since 1899 he has been chairman of the board of directors. His home is at Montreal, Quebec.

SIR ROBERT LAIRD BORDEN

The present Prime Minister of the Dominion was born at Grand Pré Nova Scotia, June 26th, 1854. He received an academic education, studied law, and soon gained a large practice. He entered Parliament in 1896 and at once became prominent. In 1901 he was chosen leader of the Conservative party. When his party gained a majority in the elections of 1911, he succeeded Sir Wilfrid Laurier as Prime Minister. He was knighted in 1914. See p. 1327.

SIR GILBERT PARKER, K. B.

In the literary world we find Canadians attracting considerable attention. One very successful English writer of to-day is a Canadian, Gilbert Parker. He was born at Camden, East Ontario, in 1862. After receiving his teacher's diploma, he taught school for a short time. In 1883, he entered Trinity University, Toronto, where he remained for two years. After giving up his college course, he taught for a few months in the Deaf and Dumb Institute at Belleville, went to Australia in 1886, and became associate editor of the Sydney Evening Herald. He turned playwright, dramatised Goethe's Faust, and wrote a play, The Vendetta. After four years of successful work he settled in England in order to devote his entire time to literature. He first gained recognition by his short stories. For his success in the literary world he was knighted in 1902. Since 1900, he has been a member of the British House of Commons. His chief novels are Northern Lights, The Weavers, A Ladder of Swords, The Right of Way, The Seats of the Mighty, and The Trail of the Sword.

CHARLES G. D. ROBERTS

Another Canadian whose works are widely read is Charles G. D. Roberts. He was born near Fredericton, N. B., in 1860. He attended the common schools and then the University of New Brunswick, where he graduated in 1883. After teaching school for a year, he went to Toronto to become editor of a paper called The Week. In 1885, he was called to a professorship in English and Economics in King's College, N. S., and there remained until 1895 when he resigned to devote his entire time to literature. Two years later he went to New York, but did not remain. His important books are The Backwoodsman, The House in the Waste, The Heart that Knows, Red Fox, The Watchers of the Trails, Canadians of Old, and Around the Camp Fire.

REVEREND CHARLES W. GORDON (RALPH CONNOR)

A writer whose works are widely read in Canada and the United States is Charles W. Gordon, better known as Ralph Connor, the name under which his novels appear. Charles Gordon was born at Indian Lands, Ontario, in 1860. He attended the common schools and then Toronto University, from which he graduated in 1883. For a time he served as a missionary in the Northwest Territories. In 1893, he was called to the West End Church, Winnipeg. His important novels are The Sky Pilot, Black Rock, The Man from Glengarry, The Doctor, The Settler, The Prospector and Glengarry Days.

THE LIBRARY OF PARLIAMENT

This building is decidedly unusual in appearance, but is pleasing nevertheless. It is the Library of Parliament at Ottawa, Canada, and may also be used as a public reference library. It contains about 300,000 books, including nearly everything that has been written about Canada. The building has sixteen sides, and the flying buttresses surrounding the central tower give a pleasing impression. The interior is decorated with the arms of the Dominion and the separate Provinces.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Un jour Georges alla promener son chien. Il rencontra un garçon boucher.
One day George went to walk his dog. He met a boy butcher.
One day George took his dog out for a walk. He met a butcher's boy.

Il portait de la viande sur un plateau. Pat sauta et vola un gigot.
He was carrying of the meat upon a plate. Pat jumped and stole a leg of mutton.
He was carrying some meat on a tray. Pat jumped up and stole a leg of mutton.

Pat décampa dans la rue ; Georges courut après Pat et le garçon après Georges.
Pat decamped into the street ; George ran after Pat and the boy after George.
Pat ran down the street ; George ran after Pat and the boy ran after George.

Un petit garçon traversait la rue avec une grande boîte sur la tête.
A little boy was crossing the street with a large box upon the head.
A little boy was crossing the road with a big box on his head.

Le méchant Pat courut au garçon, le fit tomber et renversa la boîte.
The naughty Pat ran to the boy, him made to fall and upset the box.
The naughty Pat ran up to the boy, knocked him over and upset the box.

Le garçon était très furieux. Il se releva et suivit Pat pour le frapper.
The boy was very furious. He himself recovered and followed Pat for him to strike
The boy was very angry. He picked himself up and ran after Pat to beat him.

Pat courut jusqu'à ce qu'il arriva à une femme qui vendait des pommes.
Pat ran until this that he arrived at a woman who was selling some apples.
Pat ran on till he came to a woman selling apples.

Pat fit tomber la corbeille de la femme et les pommes roulèrent sur la chaussée.
Pat made to fall the basket of the woman and the apples rolled upon the roadway.
Pat knocked over the basket and the apples fell out into the road.

La femme se releva et jetta la corbeille au chien. Pat était enfin attrapé.
The woman herself recovered and threw the basket at the dog. Pat was at last caught.
The woman picked herself up and threw the basket at him. Pat was caught at last.

On le conduisit à la maison et son petit maître le punit de son espièglerie.
They him conducted to the house and his little master him punished of his frolic.
He was taken home and his little master beat him for being naughty.

A VISIT TO NEW YORK

WE are going to pay a visit to New York, and since New York is the largest seaport, as well as the metropolis of our land, we shall enter it by its beautiful harbour.

THE CENTRE OF THE COMMERCE OF THE WORLD

New York City has one of the finest harbours in the world, and, as we sail up the Inner Bay, we see about us on every side signs that mark it as a great world centre of commerce. We pass ships and sea craft of every kind and description, coasting schooners laden with lumber, and big, full rigged clipper ships that have to be towed from the Lower Bay by puffing little tugs that snort and screech at every provocation. Slim white river boats churn past us, looking very frail and flimsy by the side of the huge ocean liner slowly making its way past the great bronze Statue of Liberty. As we approach nearer the city we see everywhere the dumpy ferry boats slowly nosing their way hither and thither.

Our first glimpse of the metropolis itself shows the high, piled-up masses of the buildings, their irregular outlines clear-cut against the blue sky. New York has perhaps the highest and most notable sky-line of any city in the world, and as we sail up the Bay and into the North River we are oppressed by the vague feeling that the low-lying southern end of Manhattan Island will surely some day tip over under the awful weight of its buildings.

BATTERY PARK

When we have passed through the hands of the quarantine and custom-house officials we land at the pier on the western side of the island, and push past the crying cabbies into the city streets. For a moment our breath is fairly taken away by the turmoil into which we are plunged. Heterogeneous crowds of people, — well dressed business men and trim-looking girls, tramps, sailors, street urchins, immigrants with great bundles balanced on their heads, stream past us. The clatter of carts and trucks through the streets, the rattle and clang of the elevated road and the trolleys, the squalling children, the newsboys diving through the crowd, lustily shouting their "extras" — make a hubbub, which, after the comparative quiet of the steamer, seems almost deafening. Gradually, however, the seeming chaos of noise and hurrying crowds resolves itself before our eyes into the more or less orderly bustle of a great city.

OLD DUTCH NEW YORK

Seeing Battery Park to-day, it is hard for us to realise that this teeming centre of a great city less than three hundred years ago was a sleepy little Dutch settlement on the edge of a virgin forest, — a mere handful of quaint red brick houses with checker-board fronts and gabled roofs. Behind each house was a garden of gay flowers brought by the Dutch settlers from their native land, the gorgeous tulip of Holland predominating. Great oaks and elm trees lined the streets and to the south toward the sea stood a fort with a quadrangular earthwork, mounting twenty or more curious, round-mouthed, bronze cannons. On one side could be seen a quaint windmill turning cumbrously in the wind, and not far from Battery Park, on Bowling Green, stood the village tavern, where resorted the better class of merchants and citizens to sip their beer and talk over matters of general interest. Tacked up in the inn was the following notice:

"Whereas we are informed of the great ravages the wolf commits on the

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small cattle, therefore, to animate and encourage the proprietors who will go out and shoot the same, we have resolved to authorise the assistant schout (sheriff) and schepens to give public notice that whoever shall exhibit a wolf to them which hath been shot on this island on this side Harlem shall be promptly paid therefor by them, for a wolf fl. 20, and for a she-wolf fl. 30, in wampum or the value thereof."

This is the entrance to the United States Sub-Treasury on Wall Street. It stands on the site of Federal Hall, where our government was organised, April 30, 1789. This fine statue of Washington, by J. Q. A. Ward, stands on almost the same spot where he stood when taking the oath of office. This is now the busiest part of New York.

FAR-FAMED BROADWAY

We have come to see the city, so with the memory of those old Dutch days in New Amsterdam still fresh in our minds, we walk across Battery Park and stroll up Broadway. Our walk up town begins where the real Broadway begins, with its crowded sidewalks, its continuous roar, its intent crowds of foot-passengers, and its clanging trolley cars, with the "down-towners" dodging them automatically. On both sides of us rise the sky-scrapers. Men and women, gazing straight ahead, dash in and out of the great revolving cage-like doors. The human voice does not reach very far on lower Broadway. A gong, a honk or a whistle would do better service. People, when they want to talk quietly, go inside.

TRINITY CHURCH

We come abreast of Trinity Church, with its old churchyard where sleep the historic dead, an island of quiet in the midst of the turmoil of the city streets. As we stand on the corner of Broadway, hesitating, the faint strains of an organ

Photograph copyright by Keystone View Co.

THE BATTERY AS IT WAS AND IS NOW

The Battery, at the very tip of Manhattan Island, has always been a favourite meeting-place. This is an artist's idea of the way it looked during the days when the Dutch held New York.

The Battery still has thousands of visitors who sniff the salt air, visit the Aquarium, and look out upon the beautiful bay, where smoky tugs, clumsy ferry-boats, or rusty freight-boats continually pass. Sometimes one may see great ocean liners slipping down-stream; or you may turn your back on the bay and look back at the city.

Photographs by Paul Thompson, New York.

steals out to us, and we turn aside and pass through the great door into the twilight aisles of the church. A service is in progress and a few dim figures are scattered here and there among the pews. The subdued sunlight sifts softly through the stained glass windows and touches the carpeted floor, and above the sullen murmur of the city, the impertinent note of a sparrow in the churchyard is heard.

The Stock Exchange

With the hush of the sanctuary still upon us, we issue from the church into the roar of Broadway, and turn down Wall Street to pay a visit to the Stock Exchange. We are admitted on the card of a friend, climb up into the visitor's gallery, and for a moment as we look down upon the "floor" we feel as if we had strayed into "a lunatic asylum temporarily freed from the restraint of the keepers." But the hammering and the clamour and the hysterical cries of the bidders are not, however, so insane as they appear to us. To those in the thick of the bidding it is evidently as matter-of-fact as the loud announcement of the train ushers in the railway stations or the street cry of the newsboys or fruit vendors.

As we leave the Exchange and walk a block or two up William Street we have the sensation of walking between the walls of a canyon. "They move almost as much on the perpendicular as on the horizontal plane. When they find themselves a little crowded, they simply set a street on end and call it a sky-scraper." In many of the office buildings, such as tower above us on every side, they have express elevators that carry visitors to the twentieth or thirtieth stories without a stop. According to Mr. Stevens, the architecture of New York City is "the outward expression of the freest, fiercest individualism."

St. Paul's Church

Crossing over through Fulton Street to Broadway again we come out in front of St. Paul's fine old church. This solid, colonial edifice — a colossus of architecture in its day — seems almost dwarfed among the surrounding towers of the tall office buildings; and it turns its solid back upon busy Broadway with all the contempt of a conservative, old-fashioned gentleman toward the antics of "modern civilisation." Beyond St. Paul's lies the ugly, triangular City Post Office. Then comes City Hall Park with the entrance to Brooklyn Bridge to the right.

Washington Square

On our way up town we turn aside from Broadway for a few moments to catch a glimpse of Washington Square, with its new, imposing Washington Arch. After the hum of the traffic on Broadway this old Square seems surprisingly quiet and retired. With its handsome, old, wide-fronted houses of red brick with their white stoops, and its air of refinement and established repose, Washington Square has a "riper, richer, more honourable look" than the busier portions of the metropolis.

Back once more upon Broadway, we take a peep at Wanamaker's new store and pause for a moment to look at the slim gray stone spire of Grace Church, rising sharp and needle-like against the clear sky.

As we proceed up town we feel a temptation to turn aside to visit Stuyvesant Square and Gramercy Park, which, like Washington Square, are old-fashioned little islands of tranquillity in the midst of a whirlpool of modern hurry and clamour. But we have little time, so we cross Union Square to that part of Broadway which was once the most interesting. It used to be the fashionable shopping district, and still contains some of the large department stores, although there is a growing tendency to move further up town. The crowd we meet is still cosmopolitan, but it is not so hurried and business-like as on lower Broadway. Here instead of the business woman we see fashionably gowned shoppers in their "trotting suits" hurrying in and out of the stores. "Yet all these people are not shoppers by any means, for along this bit of Broadway mingle types of every kind and description, — nuns, actors, gentlemen, pickpockets, detectives, sandwich men, little girls

COOPER UNION AND GRACE CHURCH

Peter Cooper was a poor boy, who had few opportunities to get an education, but nevertheless made a large fortune. He established in New York City an institution known as Cooper Union, to help those like himself. In the building are night schools, an art school, a lecture hall, a library and the like. The statue of Cooper before the entrance is by St. Gaudens.

Grace Church is one of the most prominent churches in the city, and tries to reach every one. In the open pulpit services are frequently held and large crowds gather on the lawn to listen to the minister.

Lower photograph by Paul Thompson, N. Y.

going to Huyler's, — the best people and the worst people." With the march of trade up town, this description no longer fits quite so well, but the section is still interesting.

Madison Square

At last we have passed the queer, slim, triangular Flatiron Building and have come to Madison Square, the place of places in New York, the picture of which rises up before the eyes of every homesick New Yorker in a foreign land. Before us lies the Square in the clear sunshine of the early afternoon, with the "creamy Garden Tower" standing out over the trees, — clear-cut against the sky, "Diana on top glistening in the sun;" a soft purple light under the shadows of the branches of the trees in the park; a long line of taxis waiting for "fares" semicircling about the statue of Admiral Farragut, and "lithe New York women, wearing clothes as they alone know how to wear them, crossing Fifth Avenue at Twenty-third Street, while a tall policeman holds back the traffic with a wave of his little finger." This is typical New York. Is it a wonder that New Yorkers, returning from abroad to their own city, and standing for a moment delightedly looking over the Square's crowded expanse, draw in a whiff of the crisp air and exclaim contemptuously "Oh, Paris!"

Madison Square Garden

No trip to New York is complete without a visit to Madison Square Garden, — a veritable fairyland of wonders to the young New Yorker. "Here the menagerie has overwhelmed him with its animals most fearful and wonderful. That complicated, noisy menagerie smell has dislocated his nose, as later the three-ring circus has dislocated his eyes. The Garden plays so important a part in the New York child's education, it is small wonder he loves it when he is grown. And it grows with him; for when the circus is over, he goes to the Dog Show, and gets deliciously frightened out of his wits by the barking of a thousand canines, leaping and tugging at their chains, and thrusting their heads out to bite, or, what is worse, to lather him with their impartial tongues. His little sister is taken to the Cat Show, where the priceless Angoras doze and purr, and where the town's practical joker once took first prize with a common tomcat picked up in the gutter. Once a year the Garden calls in all the country cousins and the farmers, real or amateur, to see the Poultry Show, where the game-cocks and the featherweight bantams challenge one another to mortal combat all day long in safety.

"In Madison Square Garden the New Yorker has seen the charge of San Juan Hill done in miniature, and the tears came to his eyes as the boys swung past chanting, 'There'll be a Hot Time in the Old Town To-night.' It was at the 'Wild West Show' he saw this, for the show has other things to tempt the spectator weary of Indians. But who can ever weary of the tame savages in their outrageous make-up, or the old Deadwood stagecoach that goes round and round, pursued by Indians shooting it full of paper wads and falling off to the ground as they themselves die twice a day from an overdose of blank cartridges? The famous six-day bicycle race takes place here annually, and all night long the benches are crowded with enthusiasts watching the jaded riders pumping away on their eternal treadles." Here also can be seen the Automobile Show, where motors of all kinds and colours are not the least of the attractions, for, like the Horse Show, the Automobile exhibition gathers together hosts of fashionable dames, whose gowns outrival the glories of the rainbow.

And so, since we are in New York, we shall visit the Garden, and if we are fortunate, we shall see a circus, or a Dog Show or some other delightful thing, — and being boys and girls with a wholesome love of fun, we will think Madison Square Garden the finest and most interesting place in all New York City — save perhaps the Hippodrome, which every boy, who has visited it, knows is the most wonderful place in the world.

We shall continue our visit to the upper part of New York in another volume.

TWO SPOTS OF GREEN AMONG THE STONES

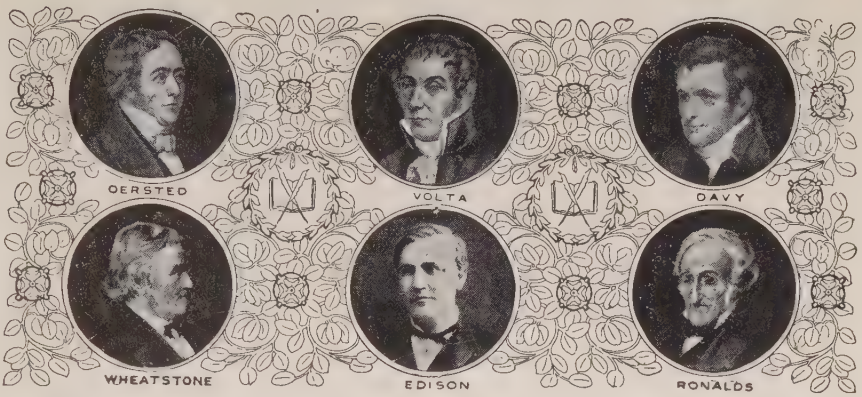
Madison Square was once the home of fashion and wealth, but now has become the home of business. The Metropolitan Tower is one of the tallest buildings in the world. The clock can be seen for miles. The building to the left is the Madison Square Presbyterian Church, one of the most beautiful in the city.

Washington Square, where stands the great Washington Arch, erected in 1889, as a reminder that a hundred years before George Washington had been inaugurated as President in New York City, is one of the most attractive small parks in the city, though many of the old residences are now used for business purposes.

The lower photograph by Paul Thompson, N. Y.

THE FIRST REAL TELEGRAPH EVER MADE

Although many men had dreamed of sending messages across long distances by electricity, it was an Englishman, Sir Francis Ronalds, who was the inventor of the first real electric telegraph. Here we see the arrangement by which he erected eight miles of wire in the garden of his house at Hammersmith, the house that was afterwards occupied by the poet and reformer, William Morris, of whom we read on page 3704. Ronalds offered his invention to the British Admiralty, but it was rejected on the ground that telegraphs were unnecessary.



THE MAKERS OF TELEGRAPHS AND TELEPHONES

CONTINUED FROM 4294

No one can tell us in a sentence who made the telegraphs and telephones. There have been too many men concerned in these inventions for the story to be given in few words. The savage who lights a fire, so that the smoke may be seen from afar by his comrades, is using a telegraph such as all men used once upon a time. The army signaller who waves two flags about in a particular manner is telegraphing. The man who uses the heliograph—a mirror which reflects the rays of the sun—is using another old-time method of telegraphing signals.

Every boy and girl who has used a piece of looking-glass to reflect the rays of the sun into dark corners has been using the heliograph telegraph without thinking of the wonder that he or she was performing. Boys and girls call the dancing light which they make with their little mirrors a Jack-o-Dandy. It is worth remembering, when we use them, that this sort of thing, on a much greater scale, of course, used to serve as a telegraph apparatus for the whole of Algeria nearly a thousand years ago. By an arrangement of large mirrors they used to telegraph with sun-rays from one end of the country to the other. And to-day the people of California use the same contrivance, and with their mirrors telegraph, by the aid of the sun, nearly two hundred miles. We do not know who first thought of using a mirror and the sunshine to telegraph. Many of the most wonderful things in the world were done by men whose names remain unknown.

We do not know for certain the name of the man who first suggested the electric telegraph, which everybody really means now when he talks about the telegraph. Of course, the way of working it is very different from the working of any other telegraph; but we can see that the same forces of Nature serve to carry the sight of the savage's camp-fire smoke and the reflected rays of the sun and the mysterious electric message which flits with the speed of light along the telegraph wires, or without wires at all, simply through the open air.

The way for the telegraph was being prepared, piece by piece, by those clever, painstaking men who found out about electricity for us in the manner described on page 2113. They never dreamed to what they were leading. They loved knowledge for its own sake, and little thought of the tremendous gift that they

were giving to the world. If we would find the very cradle of the electric telegraph, we ought to seek it in that Leyden jar from which the jolly Bluecoat boy, Stephen Gray, about whom we read on page 2115, sent a current of electricity for a distance of nearly 900 feet along a little cable. Sir William Watson, as we read on page 2116, did better than this by sending the current from one Leyden jar to another placed two miles away.

THE UNKNOWN MAN WHO WAS THE REAL FATHER OF THE TELEGRAPH

This was interesting, and was wonderful new learning for the scientists; but it did not seem to lead anywhere in particular until, in 1753, an unknown man wrote to a paper in Scotland suggesting that we might use these electric currents for sending *messages* to a distance.

He had two schemes. One was to have a wire for each letter of the alphabet, and for a current to be sent along the wire A when that letter was meant. The current would agitate a piece of paper at the receiving end of the wire, and on that piece of paper would be printed the letter A. Or the current might act upon an automatic inker which would print a sign standing for A, or whatever the letter might be. His second proposal was the better one. That was to have only one wire, and for a light ball at the end to be so agitated by the electric current that it should strike a bell and give signals which would stand for letters, and be read off and written down by the person at the receiving end of the telegraph wire.

We do not know who that man was, though some people believe him to have been a Greenock doctor named Charles Morrison. He must have been a man with a very clear mind, for, as we know, the method of giving the electric signals that is in general use everywhere to day is not so very different from the second suggestion that he made.

THE MANY CLEVER MEN WHO PREPARED THE WAY FOR THE TELEGRAPH

But, no matter what had been proposed then, they had not the means to carry it out. They could not produce electricity in sufficient force to make a good telegraph. The discoveries of Volta, giving the world the Voltaic pile, were seized upon as a royal road to success in the new field. Nearly all the men of this period, of whom we read on pages 2113 to 2121, did something to help by their discoveries, not deliberately, but by placing their knowledge at the disposal of others who were fixing their thoughts on telegraphy. The effects of electricity upon water and upon the salts of minerals, far away as they seem from an ordinary telegram, all had their share in helping towards the end.

Those great men, Humphry Davy, the chemist's apprentice, and Michael Faraday, whom Davy helped to success, were among those who did much for telegraphy at this stage by finding out some of the greatest secrets of electricity and its effects. Oersted, as we read on page 2119, found that an electric current turns the magnetic needle.

All the world might have known this and have been no better off had not Faraday, the poor blacksmith's son, worked on and found out that the magnet will electrify wire through which no current is passing. This led him to show us that we can perform the wonders described on page 2120.

THE FAMOUS DISCOVERY THAT MADE THE ELECTRIC TELEGRAPH POSSIBLE

A great power was thus placed at the command of men. They could create as much electricity as they needed, and could use it as they wanted, without fear of its escaping or of the supply running down, as was bound to happen with the Leyden jar or the Voltaic pile.

Still, the first real telegraph did not come from Faraday's discovery. It was one which cost its maker a great deal of care and anxiety and money—and disappointment. The inventor was a man named Ronalds, who afterwards became Sir Francis Ronalds. He was the son of a London merchant, and was born in 1788, just when attention was being turned by so many people to the problem of electricity.

When he grew up he gave all his thought to the study, and succeeded in making a telegraph system in his own garden at Hammersmith with wires eight miles long. He made the wires run round the garden many times, so that all this length of wire might be employed. Then he had an arrangement for creating electricity by friction, and he could send a current right through

S. F. B. Morse, an American artist, invented the well-known Morse system of telegraphy, which has been adopted in almost every part of the world. The first message, "What hath God wrought?" was sent from Washington to Baltimore in 1844. Morse, who is seen in this picture making his experiments, lived for years without recognition, but later he received honours and rewards from almost every European Government.

Sir Charles Wheatstone, who did for England what S. F. B. Morse did for America, had an intense love for science from his earliest childhood. He worked in the shop of a music-seller, but found time to study physics, and after many experiments he invented, with Sir William Cooke, the instrument from which has grown the telegraph system in use throughout Great Britain. Here we see Sir Charles Wheatstone working his instrument

the whole length of his wires. At each end he had a dial which, acted upon by the current, caused a letter to appear before an opening in the dial. This arrangement was controlled by the action of a pair of pith balls, through which the current passed. Having got his machine perfect, Ronalds offered it to the Government, which at that time had only wooden signals worked by hand for their telegraphs.

A BRITISH GOVERNMENT THAT THOUGHT THE TELEGRAPH UNNECESSARY

But they would not hear of an electric telegraph. "Telegraphs are wholly unnecessary, and no other than the one in use will be employed," they answered. Governments are sometimes very stupid. Ronalds gave up telegraphy, and the field was left to others, and, being a cheerful, unselfish man, he rejoiced that others should succeed where he failed. He saw the telegraph in operation all over the country before he died. The success of the plan is due to Sir Charles Wheatstone, who was born in 1802, and died, two years after Ronalds, in 1875; and to Sir William Fothergill Cooke, who was born in 1806 and died in 1879.

It is strange that these two men should have come together to do this great work. Cooke was, for many years, in the Army in India, and became a doctor. Wheatstone was the son of a Gloucester musical instrument maker, and was sent to London to the shop of an uncle who was a music-seller.

Both loved science, and were specially attracted to the study of electricity. Wheatstone was able to give his time more and more to this pursuit, and became noted for his writings on various scientific subjects, and was appointed a professor at King's College. In the cellars of the college he conducted important experiments. Among these was a test of the speed at which an electric current travels along a wire.

HOW WHEATSTONE AND COOKE MADE THE FIRST PRACTICAL TELEGRAPH

Cooke first heard of electricity in connection with the telegraph while he was studying medicine abroad. His quick mind soon saw that there were great possibilities in it; so, giving himself up to the work, he came to England, and entered into partnership with Wheatstone. The result was excellent. Cooke was a good business man, Wheatstone was a genius. Together they made the first practical telegraph ever used in England. It was first used in 1838, on the London and Blackwall Railway. Like nearly all new things, it was not perfect. It had five miles of wire, which, of course, made it very expensive. In the following year the number of lines was reduced to two, but even this was too costly, so in 1845 the partners brought out a telegraph for which only one wire was required. It was practically the same instrument as is used to-day for small offices, which we have seen described on page 3521.

In the end a quarrel arose between the partners as to which had played the more important part in the invention of the telegraph. Wheatstone said frankly that, but for the help of Cooke, he could not so soon have produced the telegraph, adding, however, that Cooke alone could never have produced it. That statement seems accurately to sum up the dispute.

S. F. B. MORSE, THE PAINTER, WHO INVENTED THE TELEGRAPH FOR AMERICA

While these two clever men were working in England, S. F. B. Morse, about whom we read on page 2474, was bestowing an even greater benefit on America. Born at Charlestown, Massachusetts, in 1791, he was a gifted painter and sculptor, and went to England in 1811 to study art. While on a voyage from Havre to America in 1832 he met on board a certain Dr. Jackson, and with him discussed the science of electricity. It so happened that Jackson had with him a galvanic battery and an electro-magnet. These, however, were in his trunk in the hold of the ship, and could not at the time be reached; so he drew rough sketches of them for Morse as they talked.

Morse thought of their conversation, and when he got back to America he worked long and hard at the problem, and in 1835 produced a telegraph in which, of course, the battery and magnet played an important part. Jackson had the impudence to claim the invention as partly his, and went to law about it, but was defeated. In 1837 Morse showed a better instrument, and asked for a patent, but Congress did not give aid until 1843.

A message was sent from Washington to Baltimore in 1844; but Morse performed service quite as valuable. Indeed, it is Morse's alphabet which is everywhere used for telegraphy, and his method is now employed for sending the messages over the wires. Of course, many other men have played important parts in the history of telegraphy, but the character of their work is too technical for us to consider. The great triumph was won when all the principal railways of England adopted the invention of Cooke and Wheatstone, for from that beginning her whole national system of telegraphy has sprung.

There is one great name in the history, however, which we must not overlook, the name of Lord Kelvin. He was born in Belfast in 1824, the son of a professor of mathematics, and, when only eleven years of age, was received as a student at Glasgow University. He afterwards studied at Cambridge University. All his life he worked out problems of the most difficult character, as to the strength, action, and effects of electric currents under all sorts of conditions.

LORD KELVIN'S GREAT WORK FOR SUBMARINE AND WIRELESS TELEGRAPHY

To most people it would have seemed dry, unproductive work, but his splendid mind was able to apply to practical uses the discoveries resulting from his delicate experiments and profound calculations. One result was this, that we have got those wonderful cables running under the sea to all parts of the world, as we read on page 2476. Bright and Field had the task of laying the cable, but a thousand of them could not have produced the modern cables had there not been the mighty brain of Kelvin to make it possible. This is only a fragment of what Lord Kelvin did for telegraphy. Some of the most delicate and beautiful portions of his work are employed for the receiving and recording of wireless messages. It will be sufficient, however, for us to remember that, as we grow older, we shall more and more trace the labours of Lord Kelvin, and understand the value of his work for the science of electricity in general, and of telegraphy in particular. Lord Kelvin died on December 17, 1907.

So far we have considered only the telegraph, but to most of us the telephone is a still more wonderful and beautiful instrument. By its help we can talk to friends who are hundreds of miles away. We can take up the telephone receiver in Chicago, and converse with someone in Boston as clearly and easily as if they were in the next room.

THE EXPERIMENTS THAT LED TO THE FIRST TELEPHONE

The principle of the telephone is explained on page 349 so that we need not touch upon it again. It is such a marvellous instrument that it seems extraordinary that the idea of it should have occurred to several minds.

But several men did think of it. They thought of it long ago, when, in 1667, Robert Hooke made sound travel, not by electricity, but along a stretched-out wire. They thought of it again when Wheatstone made the sound of a musical box travel along a deal rod from a cellar up into a hall where a large audience was listening. But in 1837, the year that the telegraph was patented in England, Dr. C. G. Page, an American, published an essay on the music produced by an electro-magnet at the instant when the circuit is closed. That was the beginning of the idea to make electricity carry the voice.

Six years passed, and then a clever man named Philip Reis took up the theory, and, working steadily on until 1861, actually produced an electric telephone. The principle was much the same as that now employed, but he had not reached perfection.

The world waited until 1876, then a strange thing happened—two telephones were presented on the same day, and within a few hours of each other. The one was that of Elisha Gray, the other that of Alexander Graham Bell. Gray, born in 1835, at Barnesville, Ohio, lived until 1901, and was all his life devoted to electrical inventions. His claim for the telephone was registered on the morning of February 14, 1876.

HOW TWO TELEPHONES WERE PATENTED ON THE SAME DAY

But two hours earlier in the day Alexander Graham Bell appeared at the same office and presented *his*. It was a most extraordinary thing that these two men, unknown to each other, should be working at the same time on the same problem, and on the same day should appear with it complete at the Washington Patent Office. Bell's

proved the better instrument, and is the one which, with many improvements, is still in use

He was born in Edinburgh, Scotland, in 1847. With his father, he removed to Canada in 1870, and in 1872 moved to Boston, where he taught in the Boston University. When he was a boy the lot of the deaf and dumb was terribly hard, and his father, an unselfish, warm-hearted man, gave his life to teaching the dumb to talk. Young Bell, after a fine education at Edinburgh and at Würzburg, went to Canada with his father to teach the dumb. It fell to him to teach dumb men and women and children not only to talk, but to be able to send their voices hundreds of miles by telephone.

We must not forget the part played by Thos. A. Edison in improving the telephone. Neither must we overlook what he did for the telegraph. His life-story is wonderful—he has done such great things; but it is still more wonderful when we remember how wretchedly it started. Born in 1847, at Milan, Ohio, he was at work at an age when most boys are just thinking of settling down to school life in earnest. His first situation was on a railway train. He used to buy newspapers at the stations where the train stopped, and sell them to passengers on the train. Then he bought some old type and a little press, and used to print his own newspaper on the train as he travelled. It was only a tiny paper—six inches long and four inches wide; but for a self-taught boy it was really wonderful.

Edison spent all his spare money in buying books and scientific instruments. He had a little laboratory on the train in the baggage-car, where he used to carry out experiments. One day he overturned some acid, and set fire to the car. The baggage-master pitched him out, and his career seemed ended. But he did not despair. One day at a station he saw a little child, son of the stationmaster, on the line, just as a train was entering the station. Edison sprang on to the line and saved the child, and so gained the lasting gratitude of the child's father. The latter, in token of thankfulness, taught young Edison how to telegraph. That was the making of him.

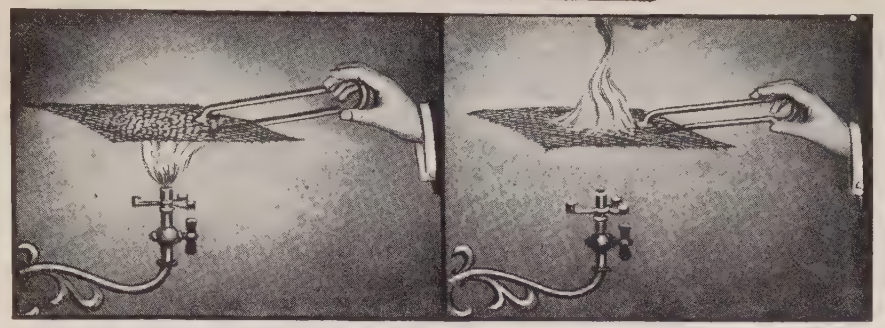
He wandered about the country, taking various situations as telegraphist, and devoting his spare time to study and experiment. The result was that, in course of time, he invented what we call the quadruplex system of telegraphy. This means, as we know, that instead of only *one* message, *four* messages can be sent over one wire at the same time. This he followed by inventing a means enabling us to send six telegrams simultaneously. We can all see how important an invention this is, for one wire can do the work of six wires.

The heliograph is a sort of natural telegraph. Messages are heliographed by the flashing of the sun's rays from a small mirror. The Morse alphabet is used, and the flashes are made long and short to represent dashes and dots.

This photograph is by Messrs. Gale & Polden

He was a restless, ambitious youth, and seldom stayed long in one place. The marvel is that he ever had time for his inventions. But he worked away, and gave us the incandescent lamp, of which we read on page 658. He invented the marvellous phonograph; he gave us one of the most important things in the telephone—the carbon transmitter; and he gave us the megaphone, that great speaking trumpet which enables us to make our voice twenty times as strong as when it leaves the throat. He invented an electric railway, the kinetograph, electric pens, and a sort of thermometer which shows the tiniest rise or fall of temperature, and another instrument which makes the beating of a fly's wing sound like a roar. In another article we shall tell you more of the life and work of this wonderful genius, who has done so much for mankind.

The next Men and Women begin on 4355.



These pictures illustrate the principle of the miner's safety lamp. If a piece of metal gauze be held over a gas-jet and the gas is lighted from below, the gas that has passed through the gauze and is on the other side will not ignite. If the gas be lighted from above, it will not ignite below the gauze.

HOW HEAT TRAVELS

CONTINUED FROM 4183

We know how heat travels by what is called convection and conduction, and now we may learn how these facts about heat were applied by a very famous Englishman, in what is called the safety lamp. This was invented about a century ago by Sir Humphry Davy, and it depends upon the fact that metals conduct heat quickly.

If we take a sheet of wire gauze and see what we can do with it to the flame of a gas-jet, we get some curious results. For instance, we can push the flame about by means of the piece of gauze, and if we hold the gauze a little distance from the gas-jet before we light the gas, we can make a flame burn on the side of the gauze away from the gas-jet, but that flame will not spread to the space between the gauze and the hole from which the gas is coming.

Now, the reason why the flame does not spread is that the gas only burns if it is hot enough, and the gauze is such a good conductor of heat that it takes up and spreads out along itself the heat made by the burning gas, so that the gas on the other side is not made hot enough and cannot burn. These facts applied in the safety lamp have saved countless lives. Davy's lamp is simply an oil-lamp which, instead of having a glass tube round the flame, has a tube or cylinder of wire gauze.

If coal-gas is in the air of the mine, it will pass through the gauze, and, when it is made hot enough by the flame, it will burn; but the flame of the coal-gas will not spread outside the lamp, because the wire gauze conducts the heat away so quickly that the coal-gas outside cannot take fire. Of course, when the miner notices the flame of the coal-gas burning inside his lamp, he will know that there is danger, and act accordingly.

Even with the safety lamp there is always a risk, for nothing is more generally true of mankind than that, in time, we get accustomed to risks, and think no more of them. The consequence is that men get careless. The gauze of the lamp might be cracked or broken, and the miner might not trouble about it; his lamp might blow out, and he might strike a match to light it again.

Further, explosions in coal-mines are by no means due only to coal-gas; they are very largely due to coal-dust. For all these reasons, something better than the safety lamp is wanted. All proper mines are now lit by electricity, and no mine should be lit in any other way. This, of course, does not mean that we should pay any less respect to the great man whose simple device saved so many lives during so many years. We must now go back for a little

while to the other kind of heat, which is called *radiant heat.* We must do so because we are discussing the ways in which heat travels, and therefore, besides conduction and convection, we must mention *radiation,* these being its three ways of travelling. If a thing is hot enough, it is not only giving off heat by conduction to the air around it, but also, like the sun or a hot poker, it produces rays of radiant heat, and in so doing loses its own heat, for, of course, nothing comes from nothing.

Radiant heat, we know, consists of waves in the ether. Its laws are simple. First, it travels in straight lines, just like the very similar kind of radiation which we call light; secondly, radiant heat, like light, can be reflected from a surface, and is reflected according to the same laws as light; also, just as light is bent when it passes from air into water, so also is radiant heat.

THE LAWS OF RADIANT HEAT THAT ARE LIKE THE LAWS OF LIGHT

Knowing, as we do, that radiant heat and light are as like one another as the sounds produced by one octave of the piano are like the sounds produced by the next octave, we shall not be surprised that the laws of radiant heat are the same as those of light.

It is true of radiant heat and of light and of sound and of the action of gravitation and of the power of magnetism, that the force of them at any given point varies in a regular way according to the distance of that point from the source of the heat or light or sound, or whatever it is. A hot thing, or a bright thing, or a noisy thing, is one-fourth as hot or bright or noisy when its distance is doubled, one-ninth when its distance is trebled, and one-forty-ninth if its distance be made seven times as great as it was at first.

These are just instances, and we shall notice that 4 is 2 times 2; 16 is 4 times 4; 49 is 7 times 7. Now, when any number is multiplied by itself, the result is called the square of that number. So we see that the law in this case is that when the distance is increased, the power is diminished, not in proportion to the distance, but in proportion to the square of the distance. Instead of having one-seventh of the power when it is moved to seven times the distance, the hot thing, or whatever it is, has only one forty-ninth part of the power. This is not because anything is lost, but simply because the action of the thing we are trying is spread out more the farther it is away, and as the amount of this spreading out is the same in every case, we understand why the law should be true for heat, light, sound, gravitation, and everything else.

AN IMPORTANT LAW OF NATURE THAT GOVERNS HEAT

The proper way of saying this is that the intensity varies inversely as the square of the distance. The word inversely is put in to mean that the greater the distance, the less the intensity. If the intensity got greater as the distance got greater, then we should say that they varied directly instead of inversely—which, literally, means upside-downly.

We know very well that light will travel through certain things, such as glass, which we call transparent, and we should expect that just as certain things are more or less transparent to light, so things ought to be more or less transparent to radiant heat. The special name for this property does not matter. We may call it transparency to heat, and all we need now remember is that things may be transparent to light which are not transparent to heat, or they may be transparent to heat and not to light. For instance, water will let sunlight through, but it will stop altogether the radiant heat, which is really part of the sunlight, just as completely as the thickest and blackest blind would stop the visible light itself.

WHAT HAPPENS WHEN RADIANT HEAT CANNOT PASS THROUGH A SUBSTANCE

On the other hand, there are fluids which are almost quite transparent to radiant heat. Nothing, of course, is ever lost, and if the water is opaque to radiant heat—that is, if heat cannot pass through it—it does not mean that the radiant heat is lost. What happens is that the water gets warm. If a fluid has the property of being transparent to radiant heat, then, in so far as it is so, it will not be made warm even in the blaze of sunlight. Different kinds of substances vary very much in their behaviour as regards radiant heat. Just as water will stop and absorb radiant heat falling upon it, while other things will let the radiant

heat through, so one kind of thing will radiate heat from itself very easily and another will not. A great deal depends upon the surface of the thing, and, in general, dull surfaces absorb radiant heat more readily than bright surfaces.

WHY A THING CAN RADIATE ONLY WHEN ITS SURROUNDINGS ARE COOL

When we say that something is radiating, we assume that its surroundings allow it to radiate, and a great deal depends on these surroundings, and especially upon their temperature. A thing radiates only when its surroundings are cooler than itself; if its surroundings were hotter, it could not give heat to them, but they would have to give heat to it. The general rule is that the greater the difference in hotness, or temperature, between a hot radiating body and its surroundings, the greater is the rate at which it radiates and becomes cool.

We must hold fast to the truth that something is never obtained from nothing. Heat radiation, as we know, is a form of energy or motion in the ether. It is a kind of power. If it is produced by anything, that thing loses in proportion; therefore, every radiating body tends to become cool, and, sooner or later, unless new sources of energy are supplied to it, must become cooled down to the temperature of its surroundings, and then its radiant days are over.

These facts are of enormous importance in the great world of astronomy. When we come to study the different bodies of the solar system, we find how important are the laws of radiation. The moon, being very small, has not been able to hold its atmosphere to itself.

THE MOON'S RAPID CHANGES FROM HOT TO COLD AND FROM COLD TO HOT

The solid surface of the moon is naked and exposed to the sun's heat, and when the sun is playing upon any part of it, that part must become intensely hot. But when that same part is turned away from the sun, it begins to radiate back into space the heat it got from the sun. In so doing it soon becomes intensely cold. In other words, the fact that the moon has no atmosphere means that its surface is constantly being subjected to many very rapid changes of temperature. We cannot believe that life could possibly flourish under these conditions; and if it be true that there are traces of humble vegetable life upon the moon, that life must be protected from the violent changes of temperature by lying deep in shaded valleys where, perhaps, a few traces of an atmosphere still remain.

Now let us consider the case of the earth. Like other bodies in the universe, the earth radiates its heat into space. The question is how far the atmosphere affects this radiation. The atmosphere, as we know, is mainly made of two gases, oxygen and nitrogen; about one part of oxygen to four of nitrogen.

It has been found that both of these gases are very transparent to radiant heat; therefore, so far as they are concerned, the surface of the earth is almost as nakedly exposed to the sun's great heat as the surface of the moon is, and, on the other hand, can radiate away heat at night almost as readily as the moon is able to do.

HOW THE WATER-VAPOUR IN THE AIR PROTECTS US FROM THE SUN'S RAYS

There is a most important gas in the air that we have not yet reckoned with, and that is gaseous water, or water-vapour, which is always more or less present in the atmosphere. We have already learnt that liquid water is very opaque to radiant heat, and the same is true of water in all its forms. Therefore, the gaseous water in the atmosphere is, for one thing, a veil mercifully protecting us from the heat rays of the sun, and it is a barrier to the radiation of heat from the earth: both the heat of the earth itself and the heat which the earth is always getting from the sun. This influence of the water-vapour in the atmosphere is one of the most important of the many all-important services performed by water for life.

Lastly, let us consider the case of Mars. The measure and the changes of heat on the surface of Mars must depend to a very great extent upon its atmosphere, and upon the gases that make up that atmosphere. We have just learnt for certain, after many years of study and doubt, not that Mars has an atmosphere, for that was known, but that there is water-vapour in it. As in the case of our own earth—though to a less degree, for there is less

of it—this water-vapour must catch the heat of the sun, and must interfere with the loss of heat by radiation from the surface of Mars. All this bears very deeply upon one of the most interesting questions in the world—the question of the existence of life, and especially intelligent life, upon Mars.

The moon, the earth, and Mars, like the sun itself, and like all other bodies, small and great, which are hotter than their surroundings, lose heat by radiation, and, as we have often noticed before, the rate at which a body cools by radiation depends to a great extent upon its size. If we consider the case only of round bodies, the bigger they are, the greater is the amount of matter in them compared with the size of their surface, and, therefore, the slower they cool. Owing to this simple law affecting radiation, we can understand why the huge sun is far hotter than Jupiter, Jupiter hotter than the earth, the earth hotter than Mars, and Mars hotter than the moon, though, to begin with, the matter composing these different bodies was all of the same temperature.

RADIUM AND OTHER ELEMENTS THAT GIVE OFF HEAT WITHOUT BURNING

One of the most astonishing discoveries of recent times is that there are certain elements which give off radiant heat unceasingly, though they are not burning, though they are getting no heat from outside, and though they are not cooling down from a state of great hotness. The best known of these elements is radium; but there is really quite a large number of them, all related in a regular way, and radium is merely one of the set. These *radio-active* elements, as they are called, have many wonderful properties, some of which we have studied; but one of the most remarkable is their power of ceaselessly producing heat, which they radiate out in all directions.

For several years after radium was discovered, the great question for science to answer was: Where in the world did this heat come from? A few rash and foolish people, not waiting to think, and eager to find fault with the work of those who think and study Nature, declared that radium upset the great law of the conservation of energy, which, as we know, says that nothing is added and nothing is destroyed, but that everything is changed. These people said that this law of the conservation of energy, which is for science the basis of all knowledge of the universe, was proved false, because here was an element, radium, which went on day and night without stopping, and made heat which, they declared, came from nowhere.

A LAW OF THE UNIVERSE TO WHICH THERE CAN BE NO EXCEPTION

Now, it is quite certain that if this were so, even only in this one case, and if the amount of heat made were ever so tiny, and if in the whole wide universe there were only just one-millionth part of a grain of radium that made heat out of nothing, then the law of the conservation of energy would not be true, and everything built upon it would have to come down.

Sometimes we say the exception proves the rule, but it all depends. In such a case as this, the tiniest exception that was a real exception would destroy the rule. Either the law of the conservation of energy is true altogether, or it is just an idle tale. If once it could be shown that the least portion of heat or anything else came from nowhere, was made out of nothing, everything we believe about the nature of the universe would have to be given up, and there would be nothing with which to replace it.

But we may forget those foolish people, whose only desire was to injure science, and who, like all who fight against truth, only injure themselves; and we must now ask: Where does this heat come from?—knowing that it must come from somewhere. Here there were great differences of opinion until more knowledge was obtained.

THE GREAT RADIUM MYSTERY THAT MEN TRIED TO SOLVE

One very great man thought, and many thought with him, that radium was able to get from the air—all the atoms of which are always dancing about—some of the power which that dancing about contains; and then they thought that the radium somehow transformed this energy obtained from the air into the heat which it gives out. But that theory, and also various other theories, which looked upon the radium as a transformer,

picking up rays or waves or motion or something from outside, and turning the energy of them into heat, have all been completely disproved.

A DISCOVERY THAT HAS TRANSFORMED OUR IDEAS OF HEAT

It has now been proved that the radium finds the source of its heat in itself; the heat comes from the breaking down of the atoms of the radium, and these atoms are slowly being broken up into other kinds of atoms which contain less energy, as part of the energy inside the radium atoms themselves was given off in the form of heat when they broke down. This discovery of a source of heat inside atoms was utterly unsuspected by anybody until a few years ago, and is one of the discoveries which mark a new stage in the history of knowledge.

Few who study the subject can doubt that the time will come—and that not remotely, though perhaps not for hundreds of years—when mankind will be able to tap, so to speak, this energy inside the atom, and use it as a source of heat to keep him warm, to drive his ships, and to do work of every kind.

Before we go on to the question of the work done by heat, there is yet one more case of heat radiation, which is of very great importance, to those who live on islands or peninsulas, and which we ought to have in our minds as part of this subject. The facts of heat radiation, as they bear upon the sea, daily affect the lives of all of us who live on any island set in the silver sea. When men study climates in general, they find that there are, on the whole, two great classes of climate—the climate found in the heart of a continent, and the kind of climate found in islands. These are called by men of science continental climates and insular climates.

WHY THE SEASONS CHANGE SO GRADUALLY IN THE BRITISH ISLES

The English climate is insular, and, like all other insular climates, owes its special features to the presence of the water round the land. The chief marks of an insular climate, such as theirs, are, that it is a rather moist climate, and that the differences between the seasons are small and gradual compared with what we find in the case of the continental climate. The one word *equable* describes this kind of climate in which summer is not too hot, winter is not too cold, and the changes from one season to another are not too violent.

Though the English always complain about the weather, they enjoy, in fact, perhaps the best example in the world of an insular climate, with all its great and many advantages for life of many kinds, and, above all, for human life. Britain would not have been Britain, and their forefathers would not have done what they have done for themselves and for us and for the world, were it not for the climate which so greatly favours the nurture of human life, and its best activities of every kind.

All this the islanders owe to the water which makes their land an island—to

> The silver sea
> Which serves it in the office of a wall,
> Or as a moat defensive to a house,
> Against the envy of less happier lands.

WHAT THEY OWE TO THE WATER THAT SURROUNDS THE ISLANDS

An insular climate owes its virtues to the behaviour of water shone upon by the summer sun. As we have seen, a great fact about water is that it is opaque to heat radiations, will not let them pass through, and by absorbing them becomes heated itself. That is what the sea does. As we shall learn, water can take in an enormous amount of heat with ease. This it does not only by absorbing radiations from the sun, but by conduction of heat from the air which is above it.

All through the summer the sea is getting warmer, partly by absorbing the radiations which strike it directly from the sun, and partly by the passage of heat into it from the air. This means that the air is cooled, and, being cooled, flows inwards over the land beneath the hotter air which is not yet cooled, as we have already learnt it must.

Thus they owe to the sea their mild summer—how mild, they have no idea until they try to spend a summer in a climate that is not so kind as their own. What it amounts to is this: that in the summer there is too much heat, and the sea steadily takes up the excess, so that they do not suffer. That is very far from being all. Nothing is lost. The

radiations which the sea absorbed in the summer, and the other kind of heat conducted to it from the air above it, must all be accounted for. The first result is that the sea gets warmer and warmer through the summer.

WHY THE SEA IS HOTTEST WHEN THE SUN HAS LOST ITS GREATEST POWER

Everyone who bathes in the sea—and everyone should do so when he gets the chance—knows very well that the sea is not at its hottest on Midsummer Day, but several weeks later. It is not the third week in June that Channel swimmers choose for their attempts, but the end of July and August, or even the beginning of September, long after the sun has lost its greatest power.

It was in August, 1875, that Captain Webb swam from Dover to Calais. For nearly twenty-two hours he was cleaving his way through the sea. In the end he felt the sands of Calais beneath his feet and staggered up the beach. Not until 1911 did any other man succeed in swimming across the English Channel. It is doubtful if any man could remain in the water for so long in May or June. The water is then too cold.

But the sea gets gradually warmed up after Midsummer Day, and all the time it is making the summer bearable. But as the autumn advances, and winter begins to come, the sun greatly loses its power, and the laws of heat begin to work in another way. Heat must flow from the hotter to the colder—whichever be hotter and whichever be colder—and just as it had to flow from the air to the sea when the air was the hotter, so it must flow from the sea to the air when the sea is the hotter.

So all through the winter, but especially during the earlier half of the winter, the sea is pouring back to the air the heat which it stored up during the summer. The sea becomes very cold, as we find if we try to bathe in it, say, in February; but the air is warmed, and so, just as summer was not too hot, winter is not too cold.

HOW THE CLIMATE OF BRITAIN DEPENDS UPON THE LAWS OF HEAT

Thus, the great features of British climate, with all that this means for the health and success of human life, and for the work of Britain for the world, depend upon the laws of the travelling of heat, especially upon the peculiar properties of water in absorbing heat radiations, and in being able to store almost any amount of heat. What it means to be surrounded at no very great distance by water, which absorbs radiant heat, we can best understand if we see what happens in other parts of the world where the state of things is different. Let us suppose, for the sake of the argument, that Britain remained just as it is, but instead of the water around it there were put an extensive bank of dry sand.

Very few of us know from experience what the desert is, and what it means to live where the surface of the earth, instead of absorbing the sun's radiations, throws them all back to the air. If such a change were made around Britain, the whole face of the country would, in a short time, be utterly changed. The Britain of to-day would cease to exist, and a new country that no one could recognise would take its place. The summer would be intolerably hot, owing to the reflection of heat radiations from the desert sand, and owing to the fact that there was nothing to catch away and store up any of the radiant heat from the sun.

WHY THEY SHOULD NOT COMPLAIN OF THE COOLING AND REFRESHING RAIN

The British complain of the rain in the summer, but they may be thankful that they must not live through a rainless summer, merciless and shrivelled, such as they would endure if they had sand instead of sea around them. On the other hand, when the winter came, there would be no rich stores of heat to be given up, so as to compensate for the lack of heat from the sun. Britain would cease to be Britain, and would disappear in a year or two with the disappearance of that climate which the British always abuse, but upon which their happiness and success as a nation depend.

So they owe more to the sea even than Shakespeare, and the British poets who have sung the sea since his time, remembered to tell, and perhaps now our British readers may even try to grumble a little less about the weather, and that will, at any rate, be something that they will have gained.

The next part of this is on page 4365

A GREAT ROMANCE OF ADVENTURE

ALEXANDER DUMAS, the celebrated romancer, who was largely inspired in his work by the example of the great Sir Walter Scott, based most of his famous stories on episodes from history, although he took great liberties with historical facts, and considered that the purposes of his tale were more important than the facts of history. Yet the greatest of his novels is one in which history plays practically no part at all. "The Count of Monte Cristo" is purely an effort of the imagination, and a more fascinating story was never conceived in the mind of a romancer. In its original form it is a work of enormous length, and takes one a great deal of time to read, though the time so spent is full of delight. Here we have endeavoured to retell the story very briefly, but even so it will require twice the space of any of the others. Only the first part of the story is printed here; the second part begins on page 4407. "Monte Cristo" was originally published in 1844.

THE COUNT OF MONTE CRISTO

CONTINUED FROM 4176

THE three-masted ship Pharaon arrived at Marseilles from Smyrna, commanded by the mate, young Edmond Dantès, for the captain had died on the voyage. Edmond was a great favourite with the crew, to whom he was more like a brother than a superior officer, and his skill in seamanship was so unquestioned that the shipowner did not hesitate to offer him the command. A captain at nineteen, his increase of pay would enable him to make his old father comfortable, and it would also enable him to marry at once the dark-eyed Mercédès, who had been his sweetheart for three years.

Little wonder, when he had set foot in Marseilles, there was not a happier man in all the city. He seemed to walk on air. His wedding was arranged, and the guests invited to the feast. Everything was prospering so much with him that more than once he said his happiness was almost too great to last.

Edmond Dantès, being naturally of a frank and friendly disposition, never suspected he could have enemies. But what he innocently considered his good luck was the means of creating enemies against him. The supercargo of the Pharaon was an envious fellow named Danglars, who would have liked to command the vessel, so that he might profit dishonestly out of its trading. Fernand, the half-Spanish cousin of Mercédès, was deeply in love with the beautiful girl, and hated Edmond because he had won her heart. Here, indeed, were enemies enough if the young sailor had suspected them for one moment. But he counted these two among his friends. It was a time of great political unrest. Napoleon, who had been lord of well-nigh all Europe, had surrendered his throne, and in the little island of Elba, which lies between his native Corsica and the coast of Italy, was plotting how he might regain his lost sceptre and revive his empire. The French throne was now occupied by Louis XVIII., the younger brother of Louis XVI., who had been beheaded during the Revolution in 1793. But the country was not satisfied with his rule, and, of course, the old veterans who had fought in the great wars of Napoleon, and all who were devoted to the idea of a great French empire, longed to see Napoleon back again.

All that was necessary to have a man cast into prison at that time was to denounce him to the public prosecutor as taking part in some plot to restore "the usurper," as Napoleon was named by the supporters of King Louis XVIII. Edmond Dantès had quite innocently come under the suspicion of being in treaty with Napoleon's grand marshal at Elba, for, in obedience to the last instruction of his dead captain, Edmond, on his way home from Smyrna, visited the island of Elba, and, going ashore

alone, received from the grand marshal an important letter, which he was charged to deliver personally to a gentleman in Paris.

Edmond was to hasten his wedding, and after the ceremony to set out upon a trip to Paris, during which he would make safe delivery of this letter.

How his enemies plotted against Captain Edmond Dantes

But meanwhile Fernand's jealousy had taken such possession of his mind that his one wish was to get Edmond removed before he could marry Mercédès. In Danglars he found a willing conspirator, who saw how Edmond's visit to Elba could at least be used to have him arrested and put under examination. Caderousse, a tailor, was at first taken into the confidence of the conspirators, but, as he came to think it was a dangerous trick to play on the young captain, he advised the others against it.

While seeming to agree, the other two went forward with their secret denunciation of Edmond; and Danglars, who was present at the wedding festival, from which Fernand in great excitement had hastened away, had the wicked satisfaction of seeing poor Edmond arrested by a magistrate and marched off to the town-hall, when he had been on the point of leaving the wedding feast to proceed to church with Mercédès for the religious ceremony.

The letter that brought ill-fortune to the young sailor

The consternation among all the friends of young Dantès was almost stupefying. Too young to know much of politics, too frank and manly to be engaged in any secret scheme, too honest to be a smuggler, they were all at their wits' end to guess why he had been arrested.

His employer, Monsieur Morrel, who believed in him absolutely and was willing to take any personal pledge for his honesty, tried to comfort Edmond's old father and Mercédès by saying it must be some terrible mistake, and that son and bridegroom would soon be restored to them.

Edmond, when brought before M. de Villefort, the deputy public prosecutor, to be questioned in his private room, was utterly bewildered at what had happened, and the prosecutor could see quite clearly the transparent innocence of his prisoner. So sure was he that Edmond was not only innocent, but ignorant of all political feeling, that he fully intended to dismiss him, until his inquiries elicited the fact that the prisoner had been found in possession of a letter from Napoleon's grand marshal at Elba addressed to a gentleman in Paris. He looked among the articles taken from Edmond, and found the letter. It was addressed to one Noirtier; and on reading the name and address the whole appearance of Villefort underwent a sudden and terrible change.

Keenly and anxiously he now questioned Edmond as to what he knew of the letter, and was satisfied that the young man knew nothing beyond the name and address of the person to whom he had engaged to deliver it.

The doom of Dantes is pronounced by the public prosecutor

Villefort opened and read the letter with further show of excited attention, and then, calling Edmond to witness that he burned it to ashes in the grate, he made him swear never to mention the name of the person to whom it was addressed. The public prosecutor was actually appealing to his prisoner!

Little did Edmond know the terrible struggle now going on in the bosom of the public prosecutor, who had to decide between recognising the undoubted innocence of a prisoner and safeguarding his own private interests, which the prisoner might by an innocent word betray. For this Monsieur Noirtier, to whom the letter in Edmond's possession had been addressed, was none other than Noirtier de Villefort, father of Villefort. He was an ardent supporter of Napoleon, whereas his son was scheming for favour at the hands of the restored monarchy, and found his father's Napoleonic sympathies so great a drawback to him that he had altered his name to avoid being associated with his father.

The letter which Edmond had brought from Elba was to inform Noirtier that Napoleon in a few days would make another bid for the crown, and, landing in France, would summon his old legions to his banner. Villefort thought he saw in this knowledge a means of advancing himself with the

Government; but the fact that he had obtained information from a letter addressed to his own father would have meant death to his father and been fatal to his own prospects had it been known. None but Dantès knew of the letter. With him safely imprisoned, Villefort's course would be free. Thus was the doom of Edmond Dantès cast.

As we know from history, Napoleon landed, and made his last heroic stand, during the period called "The Hundred Days," which ended with his final overthrow at Waterloo. Monsieur Morrel, who was a supporter of the emperor, urged upon Villefort, when it seemed that Napoleon must again establish himself, to draw up a petition in favour of Dantès, begging his release on the ground of services rendered in Napoleon's cause, since it was on that ground he had been imprisoned under Louis XVIII., who had now fled from France.

THE INNOCENT YOUNG PRISONER IN THE TERRIBLE CHATEAU D'IF

Villefort willingly made the petition as strong as possible in favour of Dantès, dwelling on imaginary services in the Napoleonic cause, but did nothing with it beyond preserving it carefully among the documents in the town-hall, expecting that it would be a terrible weapon against Dantès when, as was not improbable, and as history records, Louis XVIII. came back to the throne.

The deputy public prosecutor had decided in favour of safeguarding his own interests even at the expense of dooming to a terrible imprisonment an innocent young man.

Poor Edmond was removed from the town prison and taken under a strong guard in a boat to the gloomy island fortress of Château d'If, a prison in the sea, whence no one had ever been known to escape.

A sullen and dirty-looking undergaoler conducted him to a damp and dismal room almost underground, where a lamp flickered on a stool and some fresh straw had been laid down for a bed, a jug of water and a piece of coarse bread provided for refreshment.

As soon as the unhappy young man had passed within the door the gaoler took up the lamp, and, with a surly "Goodnight," bolted in his bewildered prisoner.

Dantès was alone in darkness and in silence, cold as the shadows that he felt breathe on his burning forehead. At dawn the gaoler found him standing as he had left him, his eyes swollen with weeping. All his senses were numbed. The gaoler had to touch him before he realised his presence.

SIX YEARS WITHOUT HOPE IN A DARK AND NOISOME DUNGEON

He could not eat the food the man brought, and when at length his awful situation dawned upon his mind, he threw himself in despair on the floor, crying out bitterly against the inscrutable fate that had worked him such woe.

Some days passed and he had occasional words with the gaoler, demanding always to see the governor, which he was told was impossible, and finally saying he would kill the gaoler if he would not promise to let Mercédès know what had become of him.

The result of this threat of violence was that the prisoner was consigned to one of the dungeons of the castle, darker and damper than the room he had first occupied, and more hopelessly lacking in all means of escape.

So the days passed, the weeks grew into months, and the months went by without the prisoner having counted them. He had languished in his dungeon for well-nigh six years when he began seriously to think of how he might starve himself to death. He had refused all food for four days, and was growing very weak, when, about nine o'clock at night, he suddenly heard a hollow sound in the wall against which he was lying. It was like the continual scratching of a huge claw, a powerful tooth, or some metal instrument scraping against stone.

THE STRANGE SOUND THAT AWAKENED HOPE IN THE PRISONER'S HEART

Weak and exhausted as he was, he feared his brain might be deceiving him, but by careful listening he decided the noise was made by someone scraping against the stones of his dungeon wall. Wild thoughts of liberty leapt up within him. The noise was going on again when the gaoler brought his breakfast next morning, and, fearful lest the gaoler should hear it, Edmond became suddenly very talkative, so that the man thought him delirious, and brought him some broth and white bread. His recent decision to starve to death was

now suddenly abandoned. He greedily drank the broth to revive his strength for what might now be required of him. He loosened a stone from the wall and struck three times with it against the wall whence the sound seemed to come.

THE UNKNOWN PRISONER MINING THROUGH THE CASTLE WALL

At the first blow the sound ceased, as if by magic. It was not heard again that day, and the night passed in silence also, so that he determined it was some prisoner cutting his way through to liberty.

All his anxiety now was to recover his strength. He no longer refused the food brought to him. The same sounds did not occur again, but after three days he felt certain the unknown prisoner was again at work, using a lever to move the stones instead of a chisel. Edmond determined that he, too, would try to cut a passage out, and perhaps join up with the other.

The only thing he could think of was to break his water-jug and conceal two or three of the fragments in his bed. With a piece of the broken jug he scraped away all night, removing the damp mortar around a large stone in the wall which was hidden when his bed was drawn up. He seemed to make but little progress, but all night long he heard the subterranean workman continuing to mine his way.

In the morning the gaoler grumbled at the broken jug and fetched in another. After he had gone, it was with a new delight that the prisoner resumed the scraping away of the mortar.

DANTES CONTINUES HIS DESPERATE EFFORT TO GAIN HIS LIBERTY

He reproached himself for not having occupied himself in this way for years. He had now been six years in his dungeon, and what might he have done in that time had he not given way to utter despair?

In three days he had removed all the cement from the stone, but the stone itself he could not move without some sort of lever. His ingenuity, so long disused, had suddenly become active again. He had noticed that his gaoler brought his soup in an iron saucepan with a strong handle, and for this he would now have given ten years of his life. How to get the saucepan with its handle as a lever for moving the stone was the next object of his thoughts. This he achieved by leaving his soup-plate on the floor, so that when the gaoler next came in he stepped upon it and broke it. The man had thus either to go upstairs again for another plate or to leave the pan containing the soup with the prisoner, and bring a new plate at his next visit. Happily, his natural laziness prompted him to leave the saucepan, and thus Dantès came into possession of the priceless instrument. Using its handle and toiling away all night, he made wonderful progress in loosening the stones of the wall. And as the gaoler forgot to bring him a new plate, still letting the saucepan serve the purpose of a plate, the prisoner had much longer use of it than he had dared to hope.

THE VOICE IN THE WALL AND WHAT IT SAID TO EDMOND DANTES

For the last three days he had heard no sound of the unknown toiler. But this was all the more reason why he should himself press on with his own work.

Day and night he toiled incessantly. The saucepan, of course, was carefully replaced, and its handle straightened so that the gaoler might suspect nothing.

But Dantès had burrowed no great distance into the wall when he came upon a mighty beam of wood which presented a dead end to the hole he had made. It would now be necessary for him to dig above or below it. The thought of such a task dismayed him. In his agony of mind he murmured aloud, beseeching God not to let him die in his despair.

"Who talks of God and despair at the same time?" said a voice that seemed to come from beneath the earth, and, deadened by the distance, sounded hollow and sepulchral in the young man's ears. Edmond's hair stood on end, and he rose on his knees.

"In the name of heaven," cried Dantès, "speak again, though the sound of your voice terrifies me!"

"Who are you?" said the voice.

"Edmond Dantès," replied Dantès, who made no hesitation in answering. "A French sailor."

"How long have you been here?"

"Since the 28th of February, 1815."

"Of what are you accused?"

"Of having conspired to aid the emperor's return."

"How for the emperor's return?

The emperor is no longer on the throne, then ?"

"He abdicated at Fontainebleau, in 1814, and was sent to the island of Elba. But how long have you been here, that you are ignorant of all this ?"

"Since 1811."

Dantès shuddered : this man had been four years longer than himself in prison.

This strange conversation was continued much further, and Edmond gathered that only a few stones had now to be removed to join up the tunnel of the other prisoner to the much smaller hole that he had made. The other tunnel was lower and came under the beam that had caused Edmond to despair. But, alas ! the heroic labours of the unknown worker had been in vain.

With incredible toil he had been making his passage through the wall for years, and had burrowed a tunnel fifty feet in length, only to find that instead of leading, as he had hoped, to the outer wall of the castle, whence he would have flung himself into the sea, it had led to the cell of another prisoner.

THE MEETING OF THE TWO PRISONERS AND THEIR NEW COMPANIONSHIP

Next day the other prisoner came back along his tunnel and made his way into Edmond's cell. They greeted each other with joy. For, at the worst, if they could continue to meet each other daily, some little of the bitterness of their captivity would thus have been removed. Edmond's new friend was a man who might have been sixty years of age. Though small of stature and very thin of face, with a long black beard, and hair that seemed to have been whitened by sorrow and suffering rather than age, he still showed considerable activity for one who had been so long imprisoned. His bright and active mind, and the healthy influence of the long task he had just finished, had helped to keep him in fit condition.

He told Dantès about the marvellous tools he had been able to make out of the scantiest material ; how he had made his chisel from one of the clamps of his bedstead, and with this chisel had been able to cut the long tunnel in the wall. He examined Edmond's cell carefully, and, climbing up by the help of Dantès to the loophole near the ceiling, he found that it looked upon a courtyard where sentries were on duty, thus cutting off all hope of escape.

"Then the will of God be done !" said the old man slowly ; and an air of profound resignation spread over his careworn countenance. He then told Dantès that he was the Abbé Faria.

THE STRANGE STORY OF THE ABBE FARIA AND HIS LONG ENDURANCE

Previous to being transferred to the Château d'If, in 1811, he had suffered three years' imprisonment in another fortress. His crime had been to advocate a united Italy and to scheme for the making of a powerful kingdom out of the petty principalities into which his native land was then cut up. This was treason to Napoleon's plans in 1807, and the abbé had been betrayed to the French.

Edmond's new friend was none other than the "Mad Abbé," though he showed no signs of madness and many of wisdom far beyond the ordinary man. Dantès was fascinated beyond expression by the abbé's account of his prison occupation, and asked him why he should not begin again, with him to help, to cut a passage which would lead them to the outer walls.

"In the first place," said the abbé, "I was four years making the tools I possess, and have been two years scraping and digging out earth, hard as granite itself ; then what toil and fatigue has it not been to remove huge stones I should once have deemed impossible to loosen.

HOW THE ABBE HAD CUT HIS TUNNEL THROUGH THE CASTLE WALL

"Then, to conceal the mass of earth and rubbish I dug up, I was compelled to break through a staircase, and throw the fruits of my labour into the hollow parts of it ; but the well is now so completely choked up that I scarcely think it would be possible to add another handful of dust without leading to a discovery. And just at the moment when I reckoned upon success, my hopes are for ever dashed from me. No, nothing shall induce me to renew attempts evidently at variance with the Almighty's pleasure."

Thus it was willed, and, as all hope of escape was finally abandoned, the two prisoners now sought by every

means in their power to hide the evidence of their daily intercourse. It was now the abbé's pleasure to pass much of the time by instructing Edmond in those branches of knowledge in which he himself was skilled.

DANTES BECOMES THE EAGER PUPIL OF THE "MAD ABBE"

Edmond proved an apt pupil, and those long hours spent by the one in giving, and the other in receiving, knowledge of philosophy, history, science and languages brought to the lives of both a melancholy pleasure, which dulled the keen edge of their sorrow.

The abbé, by studying Edmond's case, was able to show to him that the enemy who had caused his imprisonment in the Château d'If could be none other than Villefort, in whom he had been greatly deceived. His own history the abbé related at length to his younger companion, and eventually, when his strength gave evidence of failing and a stroke of paralysis disabled one of his arms, he let Edmond into his great secret. It was this secret that had won him the title of the "Mad Abbé."

Before he had been arrested, the abbé had been secretary to the Count of Spada, the last of a famous race of Italian noblemen, who had died on December 25, 1807. It had come to the knowledge of the abbé during his association with the count that one of the Spadas of the fifteenth century, who was a cardinal, was poisoned, together with his nephew, by the agents of Cæsar Borgia, so that his immense fortune might come into the possession of the Pope and his friends.

But an extremely careful study of the history of all the famous people in Rome connected in any way with the Spadas of that time had proved to the Abbé Faria that no one seemed

"THE SEA IS THE CEMETERY OF THE CHÂTEAU D'IF"

The most thrilling part of "Monte Cristo" is how Edmond Dantès escaped from the Château d'If after fourteen years' imprisonment. Another prisoner had scraped a tunnel through the wall, only to find himself in the cell of Dantès. When the elder prisoner died, the gaolers put his body in a sack to throw it in the sea. But, creeping into the cell of his dead friend, Dantès removed the body and sewed himself in the sack. Thus he was thrown into the sea and, ripping the sack up with his knife, he succeeded in swimming to a vessel, and so escaped.

to have benefited by the deaths of Cardinal Spada and his nephew. The abbé judged from this that the cardinal had hidden his fabulous riches somewhere to prevent their falling into the hands of his enemies at Rome, and had arranged to let his nephew into his secret, but no one else.

For years had Faria searched among the documents of the Spada family in the hope of finding something in the nature of a will, but discovered nothing. At the death of his patron, the count, he inherited the library of that nobleman, with its famous breviary, or mediæval prayer-book, which had been one of the treasures of the Spadas. One night, requiring a light hastily, he groped about in the darkness for the breviary, recollecting an old piece of paper, brown with age, which had been used as a marker in it, probably for centuries. He considered this of no value, as it bore no writing, and putting the end of it into the fire it began to burn. But, to his amazement, as it burst into flame he saw yellowish handwriting begin to appear upon it.

THE BURIED TREASURE IN THE ISLAND OF MONTE CRISTO

Immediately he extinguished the flame, though not before a considerable part of the paper had been destroyed. In great excitement he lighted his taper in the fire itself, and then examining the paper found that the action of the heat had brought out some writing traced originally in an ink which only became visible when held to the fire. This is what he read:

This 25th day of April, 1498, be . . .
Alexander VI. and fearing that not . . .
he may desire to become my heir, and re . . .
and Bentivoglio, who were poisoned . . .
my sole heir, that I have bu . . .
and has visited with me, that is in . . .
island of Monte Cristo all I poss . . .
jewels, diamonds, gems, that I alone . . .
may amount to nearly two mil . . .
will find on raising the twentieth ro . . .
creek to the east in a right line. Two open . . .
in these caves ; the treasure is in the furthest a.
which treasure I bequeath and leave en . . .
as my sole heir.
25th April, 1498. Cæs . . .

Being thrust into prison soon after this discovery, the Abbé Faria had given almost endless study to the task of completing the unfinished lines. After many years his efforts had been rewarded with success. He had satisfied himself that the portion of the paper which was burned away had read thus:

. . . ing invited to dine by his Holiness
. . . content with making me pay for my hat
. . . serves for me the fate of Cardinals Cap- [rara
. . . I declare to my nephew Guido Spada
. . . ried in a place he knows
. . . the caves of the small
. . . essed of ingots, gold, money,
. . . know of the existence of this treasure, [which
. . . lions of Roman crowns, and which he
. . . ck from the small
. . . ings have been made
. . . ngle in the second ;
. . . tire to him
. . . AR SPADA.

The abbé explained at great length, and with much excitement, how he had come to solve the mystery of the burnt paper, and his solution proved that on the island of Monte Cristo treasure valued at something like thirteen millions of money awaited the lucky person who knew where to find it.

THE DEATH OF THE ABBE FARIA AND WHAT IT LED DANTES TO ACHIEVE

Dantès knew the island, which lies between Corsica and Elba. Indeed, he had once touched at it. It is a rock of almost conical form, probably thrown up originally in some volcanic disturbance. Dantès traced a plan of it, and the abbé gave him advice as to how he thought the treasure might be recovered. For poor Faria had now abandoned all hope of ever being free himself to search for the treasure of Monte Cristo; and since his paralytic seizure he feared his end was near, and wished that Dantès might know his secret in case he succeeded in escaping from the prison. It was not long, indeed, before the poor abbé died. Edmond was plunged into a new agony of mind at the loss of his friend, who had been more than life to him, and at the hopelessness of the future.

HOW THE TUNNEL IN THE WALL SERVED A GREAT PURPOSE

But his wits had sharpened in his years of intercourse with the marvellous man who had breathed his last in that terrible prison. He was no longer the simple-minded mate of the Pharaon, but a man of much learning, immense resource, and now rendered bold by his desperate situation.

Thanks to the tunnel between the two cells, Dantès was able to listen to all that passed in the cell of the dead abbé. He gathered that there would be no

ceremonies about the funeral, and that the body would be buried after sunset. When the doctor had certified that the abbé was dead, the gaolers brought a large sack, in which the body, divested of its clothing, was placed, and so left in the cell. Dantès now determined to make his great stroke for liberty. Just as the abbé in life had saved and succoured him, so was he in death to provide the way of escape.

DANTES CONCEIVES A WONDERFUL AND DARING PLAN OF ESCAPE

Opening the sack, Edmond took out the dead body of his friend, and with slow and painful effort contrived to drag it through the tunnel to his own cell. Placing it in his own bed, with the face to the wall, he covered it with the rags he wore himself, so that when the gaoler came with his evening meal he might suppose the form in the bed to be Dantès asleep, as he often found him so. Edmond's next move was to take the place of the corpse in the sack, sewing himself in with the needle which had been one of the abbé's most ingenious tools. In his hand he held the dead man's knife, and with palpitating heart awaited events.

Slowly the hours dragged on, until at length he heard the heavy footsteps of the gaolers descending to the cell. With rude jokes about the "Mad Abbé," they lifted the sack, after some talk about "tying the knot," which puzzled Edmond at the time. He was placed on a bier, carried by two men, and after some further movements, which he did not understand, the party went forward, lighted by a man with a torch, through the castle passages, until they came to a door which was opened. On passing through this, the noise of the waves were heard as they dashed on the rocks below.

HOW THE PRISONER GOT CLEAR OF THE TERRIBLE CHATEAU D'IF

They ascended five or six more steps, and then Dantès felt that they took him, one by the head and the other by the heels, and swung him to and fro. "One," said the turnkeys, "two, three, and away!" And at the same instant Dantès felt himself flung into the air like a wounded bird falling, falling with a rapidity that made his blood curdle. At last, with a terrific dash, he entered the ice-cold water, and as he did so he uttered a shrill cry, stifled in a moment by his immersion beneath the waves. Dantès had been flung into the sea, into whose depths he was dragged by a thirty-six-pound shot tied to his feet. The sea is the cemetery of Château d'If.

Dantès, although giddy, and almost suffocated, had yet sufficient presence of mind to hold his breath; and as his right hand held his knife, he rapidly ripped up the sack, extricated his arm, and then his body. But in spite of all his efforts to free himself from the bullet, he felt it dragging him down still lower. He then bent his body, and by a desperate effort severed the cord that bound his legs at the moment he was suffocating. With a vigorous spring he rose to the surface of the sea, while the bullet bore to its depths the sack that had so nearly become his shroud.

Dantès merely paused to breathe, and then dived again in order to avoid being seen. When he rose again, he was fifty paces from where he had first sunk.

DANTES FINDS THE TREASURE IN THE CAVE AND BEGINS HIS VENGEANCE

He then struck boldly out to sea, which was now making for a tempest, and, fortunately, was picked up by a sailing vessel, to whose captain he explained that he was the only one saved from the crew of a Maltese boat that had foundered, and accounted for his long hair and beard by an ingenious story about a vow which had now expired. He learned that it was the 28th of February of the year 1829, so that it was fourteen years, day for day, since his arrest. He wondered what had become of Mercédès, who must believe him dead. Then his eyes lighted up with hatred as he thought of the three men who had caused him so long and wretched a captivity.

Now at liberty, and safe on board the sailing vessel bound for Leghorn, he renewed an oath of implacable vengeance against Danglars, Fernand, and Villefort. Nor was it long before he had discovered the secret cave in the island of Monte Cristo, with all its dazzling wealth, as the Abbé Faria had truly foretold. He now stood possessed of such means of vengeance as never in his wildest dreams had any innocent prisoner hoped to be able to command.

The second part of the story of "Monte Cristo" begins on page 4407.

THE BRAVE APPRENTICE

CONTINUED FROM 4178

THAT some of the greatest men have risen from the humblest circumstances is true in almost every walk of life, and certainly the Navy is no exception. Somewhere about the year 1680, a small boy sat working upon a tailor's bench at Bonchurch, in the Isle of Wight. His master being out of the way for the time, the boy had dropped his needle and was gazing out to sea, wishing he was anywhere but in that shop. He was a pauper orphan, and had been apprenticed by the parish authorities to the tailoring trade.

As he was gazing out to sea, a squadron of British warships came into sight, round a bend of the coast, and, without a moment's hesitation, the boy threw down his work, and, running out of the shop, was soon on the beach, where he jumped into a boat, and rowed as hard as he could to the admiral's ship.

The conditions of life on the warships were then very hard indeed, and recruits were wanted badly, for men were not anxious to join the Navy; so when the tailor's apprentice offered his services they were readily accepted.

It was not long before he saw active service, for on the very next morning the British ships fell in with a French squadron, and fighting began at once. The boy did his duty well, running hither and thither, as he was bidden, and taking a keen interest in the exciting events around him. At last, when the fighting had been going on for some time, and there seemed no sign of a definite result, the boy asked a sailor: "How shall we know when the enemy has given in to us?"

"Oh," replied the man, pointing to the flag flying at the masthead of the French admiral's ship, "as soon as that flag is hauled down the enemy will have given in, and victory will be ours."

"Is that all?" said the boy, and hurried away.

In those days vessels did not fight as they do now, with miles of sea between them, and almost out of sight of one another. They ran up side by side, and the crew of each tried to board the other. The tailor's boy sprang upon the deck of the French admiral's ship, which was alongside his own, and, unnoticed in the excitement, climbed with great agility up a rope-ladder, and seized the French admiral's flag. Then, wrapping it round his body, he descended with it to the deck, still unperceived by either the French or the English sailors.

No one had seen his daring action, but presently the English sailors noticed that the French flag was gone, and, supposing that the enemy had given in, they rushed upon the deck of the French ship with such impetuosity that the enemy was filled with consternation and dismay. The French gunners fled from their guns, and within a moment or two the ship was

actually in the possession of the English. Just as victory was assured, the apprentice sprang forward, and showed the captured flag to his comrades, who received it with the greatest astonishment.

The news soon spread, and the boy was led with his prize into the presence of the admiral, who praised his bravery and enterprise, and promoted him to the rank of midshipman on the spot. That a lad who could do such an action as this should rise to distinction in the Navy is not surprising. The young midshipman was promoted again and again, until he reached almost the highest rank in the British Navy, and became known in history as Admiral Hopson.

THE WOMAN WHO CLOTHED THE POOR

It is not only great and heroic acts, which appeal to the imagination, that can be described as golden deeds. Many a quiet deed of kindness or a work of mercy done away from the public gaze, and with no thought of praise or reward, has had far-reaching effects for good, and encouraged others to emulate the worthy example set them.

A striking example of this is the case of Dorcas, or Tabitha, the Christian disciple of the early Church, whose death in the midst of works of charity and helpfulness caused great distress among the poor widows of the town of Joppa.

DORCAS GIVING GARMENTS TO THE POOR

We do not know when Dorcas first became a convert to Christianity, but she soon learned the true spirit of the Master, as her kindly thought for the poor proves. She is described to us by St. Luke as "full of good works and alms-deeds which she did," so that not only had she physical beauty, as the meaning of her name suggests, but she was beautiful in character and in soul.

Then, as now, the poor women of cities and towns found it difficult to obtain proper clothing for themselves and their children, and it was in order to meet this need that Dorcas gave of her time and means.

She did not simply distribute so much money, and think that thereby her duty to the poor was fulfilled, but she worked with her own hands and made garments of various kinds—coats and cloaks—which she distributed freely among the poor and needy women of her town. The gratitude which the people felt for her on account of her loving service is shown by the fact that at her death they all came together to mourn her loss, and to pay the last tribute to her memory. Had there been no other result from her life and loving work than the good that came to the poor of Joppa, the name of Tabitha, or Dorcas, would have deserved to live and be handed down, as it has been. But the result was far more lasting, and is seen right down the ages since those times of the early Church to the present day, and never did the bright example of Dorcas give greater inspiration than it is giving to-day to thousands of willing helpers and friends of the poor.

There are few Christian churches to be found in this country, at any rate, without their Dorcas society, the aim and object of which is to do the very same work as Tabitha did nearly nineteen centuries ago.

It would be impossible to say how many of the naked have been clothed in all the ages, and how much joy and happiness have been brought to the poor, solely as a result of the example first set by Dorcas in the town of Joppa. Such acts as she performed are, we must all agree, golden deeds in the very highest and truest sense of the term.

THE VENERABLE BEDE TRANSLATING THE GOSPEL INTO ENGLISH IN THE LAST HOURS OF HIS LIFE

This picture, by J. Doyle Penrose, shows us the Anglo-Saxon teacher Bede dictating the Gospel of St. John to a boy, as told on page 4316. It is by permission of the Artotype Co.

THE MAN WHO DIED TRANSLATING THE BIBLE

THE life of Bede was a beautiful one, spent far from the din of the battle-field, the bargaining of the market, and the pleasures of the court.

All his days were passed, though he was the greatest scholar and teacher of Anglo-Saxon times, in the peaceful monasteries at Wearmouth and at Jarrow. There he studied, wrote, and taught the six hundred youths who gathered round him. For them he wrote text-books covering the then known field of knowledge; for them, and for the people, he wrote a history of the English Church, telling how Christianity was brought into the country.

So earnest and noble-minded a scholar could not bear to think that the greatest book ever written should remain a sealed book to every person unable to read Latin; and he was determined, if God gave him strength to do it, to translate at least the Gospel of St. John into Anglo-Saxon, that all might hear and understand it in their own tongue. Forty-four works, mostly in Latin, he had written during his busy life of teaching; one more—the Gospel of Love—he would leave behind him. He was getting ill and feeble, but he would not leave even to the ablest pupil a work so important as the translation of the Gospel. "I will not have my boys read a lie," he declared, "nor labour fruitlessly after my death."

Day by day Bede grew weaker; but, refusing to rest, he continued cheerfully dictating to his scribe. One of his scholars, Cuthbert, wrote a description of the last hours of his revered master, and an artist has painted a beautiful picture, given on page 4335, of the old man on his couch in his little cell, with a youth before him eagerly taking down his words.

In his History of the English People, the historian Green thus describes the scene:

The dawn broke on another sleepless night, and again the old man called his scholars round him and bade them write.

"There is still a chapter wanting," said the scribe as the morning drew on, "and it is hard for thee to question thyself any longer."

"It is easily done," said Bede. "Take thy pen, and write quickly."

Amid tears and farewells the day wore on to eventide.

"There is yet one sentence unwritten, dear master," said the boy.

"Write it quickly," said the dying man.

"It's finished now," said the little scribe at last.

"You speak truth," said the master. "All is finished now."

Placed upon the pavement, his head supported in his scholar's arms, his face turned to the spot where he was wont to pray, Bede chanted the solemn "Glory to God." As his voice reached the close he passed quietly away.

THE LITTLE GIRL TRUSTED WITH STATE SECRETS

WE look on Oliver Cromwell as a stern character, harsh to his opponents, and forbidding in his ways. Yet he could be very gentle to a little child; and for his little granddaughter he kept a warm place in his heart. He liked to have the little girl often before him; and when she was only six years old would keep her by his knee as he sat at a Cabinet Council discussing affairs of State. Some of his Ministers thought it unsafe to have even such a little girl listening while they talked about important matters concerning the country, and they let Cromwell know their fears.

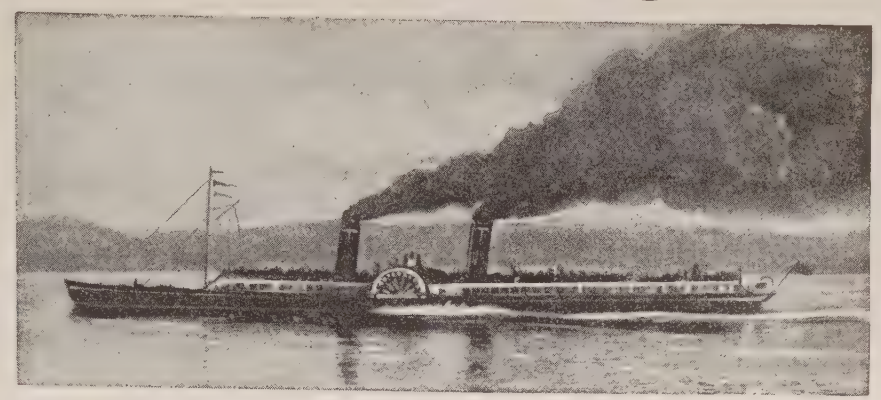
"Why, there is no secret I would trust with any of you that I could not trust with that infant," was the reply.

Determining to prove to his Ministers that his trust in his little granddaughter was well merited, Cromwell one day whispered to her something in confidence, saying it was a secret, and she must not tell it. He then set her grandmother and mother to try to get the secret from her.

But no threats or bribes, nor even whipping, could make the little girl disloyal to the trust the grandfather put in his Puritan grandchild. At last they gave up the attempt to get the secret from her, unable to resist longer the plea that her grandfather had trusted her with a secret and she must keep it, though she did not wish to disobey her mother.

And so Cromwell's Ministers had no more fear that State secrets would be told when the loyal little girl knew them.

THE NEXT GOLDEN DEEDS BEGIN ON PAGE 4445



WHERE DOES THE SMOKE GO?

CONTINUED FROM 4235

SMOKE is made up of a large number of different things, solid and gaseous. The solids are mostly too large to stay in the air, and so, after a time, they settle. There is a lot of oil made when coal is burnt, and so the black particles of carbon found in smoke are oily, and that is what helps to make them so dirty. Some of the gases are already quite burnt when they pass off in smoke, such as carbonic acid gas, and we know what happens to carbonic acid gas in the air—whether it has come from our lungs or from a furnace that is not alive.

Other gases in smoke are not completely burnt, and they get burnt up in the air, forming more carbonic acid gas, and also water, which is one of the things made by the burning of the hydrogen of coal, and is therefore always present in smoke.

ARE FLOWERS HURT WHEN WE PICK THEM?

It is very difficult to answer this question, not because we do not know the answer, but because it is not easy to use the ordinary words without giving a wrong notion of the facts. It all depends what the word hurt means; so much so that in one way we might certainly say No, and in another we might say Yes, to this question. We may be quite sure that the flower is not hurt as we are hurt by a pin-prick or a cut. The kind of feeling that we call pain is, in fact, a very high and lately developed and special kind of feeling. No plant of any kind feels pain. It is even certain that it is only among the higher types of animals that anything we may call pain can be felt; so there is no cruelty in picking a flower. But, on the other hand, we can be perfectly certain that some part of the plant feels the injury. What that feeling is like we could not say unless we could become a plant. That is largely true of all feelings: only those who feel them really know what they are like.

HOW DOES A FLOWER GROW?

All living things grow at some period or other in their lives, and the secret of growth is part of the secret of life itself, which men have not yet found out; so it is only possible to answer this question in part. We can say what are the conditions without which the flower is unable to grow. It must have light, water, air, and certain salts, containing certain elements, dissolved in the water which is sucked up by the roots. If these conditions are granted, the plant will obtain for itself the materials needed for building itself up, and the energy employed in doing so. Not much could be said

beyond this. All we know is that there is something in the life of the rose plant that determines that the flowers it bears must be roses and not lilies or wallflowers. Nor will any kind of outside change cause anything but a rose to be produced by the rose plant. The cells that contain the life of the plant are so made.

The same is true of every kind of animal and plant. Each has its own special structure, and will grow in its own special form. Exactly the same food may be given to the rose, to the lily, or to the acorn, and they will grow to be what they must; and exactly the same milk may be given to Marsie and to Marsie's kitten, to Tommy and to his puppy, and each will grow to be what its nature demands.

ARE LEAVES WATERPROOF?

The answer is both Yes and No, according to what we mean by waterproof. Usually that word means that a thing will not let water through it in either direction. That is true of waterproof clothes. But leaves and the skins of animals are only strictly waterproof in one direction. The skin or the surface of a leaf will allow no water to enter them. In both cases the body of the living creature is so arranged that the surface—whether leaf or skin—shall be the outgoing, not the incoming, channel for water.

If water could enter by this route, even after prolonged soaking, the whole arrangements for the circulation of water in the creature's body would be interfered with. When the surface of a leaf is carefully examined, we find that it has a sort of outer skin, really not so very different from ours. This is made of cells, the material of which has been changed, for this special purpose, into something which is very much the same as cork, and which water cannot penetrate from outside.

Rain is by no means bad for leaves, as it washes them and keeps them clean, thus keeping their surfaces clear for the purpose of breathing and for the use of the light that falls upon them. But the plant no more drinks by its leaves than we do by the skin; it drinks entirely by its roots. Water is able to leave the leaf, in the form of water-vapour, at various points, but water cannot enter there. Thus a leaf truly perspires, just as our skins do, and for the same purpose; and, in certain states of the air, the water may become liquid, and lie in drops on the leaf. These drops look like dew, but are really the same as the drops on our skin when we have been running or taking any violent exercise.

WHAT IS THE MEANING OF THE NAME ENGLAND?

The name England, like so many things nowadays, was made in Germany. The island has often been invaded in the past, and among the most important of its invaders were a tribe of people from North Germany, called the Angles. They settled mainly in the south part of Britain, which they called after themselves, Angleland, or, as we now say, England. The north part of the country was invaded from the other side by certain Irishmen called the Scots; hence the name Scotland applied to North Britain.

When we remember the origin of the name of England, we ought to know the celebrated story of Pope Gregory the Great, who, near the end of the sixth century A.D.—before he became Pope—saw some fair-haired English captives offered for sale in the slave-market in Rome. Their fair hair was, of course, very uncommon there, and looked very beautiful; and so he said: "Non Angli sed angeli," meaning "Not Angles but angels."

Though we still call the country England, the Angles form only a small fraction of the source of the English people to-day. The country gained, no doubt, in the long run, from all its invaders. In its people to-day there is represented not only English—in the strict sense—but also Saxon, Danish, Norman, Roman, and Scottish blood, to mention only its main elements.

WHY DOES WATER BOIL WHEN PUT ON LIME?

The answer to this question depends on a very interesting chemical process which is not difficult to understand. Water does not exactly boil when it is put on lime, but it is certainly true that the water is made very hot; and so our question really is: Where does this heat come from? Lime, or rather quicklime, is a compound of the metal

calcium and oxygen. It is therefore called the oxide of calcium, and each molecule that makes up this compound contains one atom of each of these elements; so chemists write it by this *formula* or sign—CaO—Ca standing for calcium and O for oxygen. If water gets to this oxide, the water and the oxide combine very powerfully. It is as if the quicklime drank up the water and slaked its thirst, and so we now call it slaked lime. This slaked lime is oxide of calcium plus water, and its formula is simply the two formulas added together, CaO, H_2O. The best way of writing this is $Ca(OH)_2$. The small 2 means that there are two parts each of oxygen and hydrogen. As in most other cases of chemical action—just as when a fire burns—heat is produced by this slaking of lime, and that makes the lime and the extra water that is added very hot.

WHY DOES A CLOUD FALL AS RAIN INSTEAD OF IN A LUMP?

It is only quite lately that we have been able to learn the very remarkable answer to this question. We might suppose that, when the air cooled enough, the water-vapour, or some of the water-vapour, in it would be bound to turn liquid all in a mass and then fall "plump." But water cannot behave in this way, because there are certain conditions which must always be present when it turns liquid.

It is necessary that there shall be some solid separate point or particle of something around which the water-vapour can condense when it turns liquid. It seems to matter very little what the thing is, but there must be something, and the consequence is that rain falls in drops. It is the discovery of the cause of the formation of raindrops that enables us to answer this question. The particles that perform this service for the drops may be small or great. Oftenest, perhaps, they are visible specks of dust or dirt, and so on.

We have also discovered that the molecules making up the gases of the air are liable to be broken up in a peculiar way by the action of electricity, and raindrops can form upon these broken-up molecules. We shall not learn much more about the weather until we know more of the electrical happenings in the air.

DO WE GET A POUND OF ICE FROM A POUND OF WATER?

When we use such words as pound or ounce, we are concerning ourselves with the notion of weight; that is a different thing from mass, of course. The mass of a thing is the amount of stuff in it, and is just the same whether a thing is on the sun or the moon or the earth, though its weight would be very different in those three cases. Now, if we take a pound of water and turn it into ice, the mass of it will remain the same. We allow nothing to run away and we add nothing to it, so we have there the stuff which we had before, and nothing but that stuff; and the only question is: Does it weigh the same when it is frozen as when it was liquid? That, in other words, is the question asked here.

The answer is that most careful experiments have been made for many years past on this very point, and they all go to show very clearly that gravitation is not affected in the slightest degree by any change of temperature, however extreme. The amount of stuff which weighed a pound when it was liquid water weighs neither more nor less, but exactly the same, when it is frozen. If, however, instead of asking this question about weight, we had asked one concerning volume, or size, the answer would have been quite different. For instance, we do not get a quart of ice, so to speak, from a quart of water, because the water expands, as it is frozen, to form ice; and so we get more than a quart of ice from a quart of water.

WHY DO SOME COLOURS APPEAR DIFFERENT IN GASLIGHT AND IN DAYLIGHT?

The colour of anything that gives no light itself, but shines by reflecting, or throwing back, to the eye the light that falls upon it, depends on much more than the thing itself. Of course, the thing itself is very much to be reckoned with, but as it makes no light itself, it plainly can only reflect the whole or certain parts of the light that falls upon it. It is creating nothing—only giving back to our eyes a certain part of what falls upon it.

Whether in gaslight or in daylight, the thing itself is the same, but its colour is liable to change if these two kinds of light are not the same. Let us

suppose that a thing is able to reflect only a certain pure shade of blue, and that that blue is found equally in gaslight and in daylight. Then the colour of the thing will be the same in both cases. But in many respects gaslight and daylight are very different. Our eyes tell us at once that there is more yellow, for instance, in gaslight than in daylight. But that is only one of many differences. The colour of a thing may be a mixture, because it sends back to the eye two kinds of light together. Then, if one of these kinds of light does not go to make up part of gaslight, or is only very weak in gaslight, we shall see the thing entirely or mainly by the other of the two colours that went to make up its daylight colour—and so it may look very different.

All this depends, of course, upon the fact that daylight, gaslight, and, indeed, practically all the kinds of light that we ever use to see by or that are made in natural ways, are made up of a certain mixture or balance of light of many different colours; and the particular mixture varies in different cases. Even sunlight is by no means the same mixture of colours at all hours of the day.

WHY IS WHITE CLOTHING WORN IN SUMMER AND BLACK CLOTHING IN WINTER?

In the ordinary weather of the two seasons we wish to keep cool in summer and warm in winter, and so, as a rule, we wear cool clothing, as we call it, in summer, and warm in winter. We call clothes warm or cool according to whether they let the heat escape with ease or with difficulty from our bodies. This depends partly on the weight of the clothing, partly on its material, and partly on its texture.

But there is another way in which clothing may affect our temperature, quite apart from the question of how good or bad a conductor of heat it is. Exactly the same clothes will be cooler when white than when we have them dyed black. If we are to explain this, we must know what causes blackness and whiteness. A thing lit by white light is white because it returns to our eyes the whole, or nearly the whole, of the light that falls upon it. To a great extent it treats the rays of radiant heat that go with the light, and are really part of it, in the same way. But if it returns these things they will do little to it. Now, a black thing absorbs the light that falls upon it. Black is not a colour, but the absence of any colour, and a black thing is black because it does not send back from its surface the light that falls upon it. On the contrary, it absorbs this light, and also a great deal of the heat that comes with it.

The light that is absorbed disappears, but nothing is ever lost, and we must ask what becomes of it. The answer is that it is turned into heat—it is used up in warming the black coat that absorbs it. Thus in two ways the black thing is heated, and that is why we find it pleasanter for winter wear, while in summer we choose what will send back the heat and light.

WHAT CAUSES CREAM TO FORM ON MILK?

Cream is mainly made of the fat of milk, though we should always remember that it also contains a lot of the invaluable protein or albumin, too, caught between the particles of fat. For the fat in milk is not simply melted or dissolved in it, but consists of a vast number of tiny round balls of oil. The Latin word for a little globe is *globule*, and that is the proper name for these balls of oil.

When the milk is drawn, the oil globules are fairly equally distributed through it; but when the milk is allowed to stand, the principle of specific gravity, which we read about on page 3814, comes into play, and the oil, being lighter than water, of which milk mainly consists, slowly rises to the top. If milk were pure water, the oil would rise at once; but milk contains protein and other things dissolved in it, which retard the natural process of cream formation.

DO MICROBES HELP TO MAKE CREAM?

Nowadays we are usually in a hurry, and cream is therefore very often got from milk artificially by the use of what is called a *separator*. This method is more thorough, as well as quicker. But we have lately learnt that there is a good deal more than this going on in cream. The making and what is called the "ripening" of cream depends very much upon microbes—not nasty but friendly ones—which naturally live in milk. Different kinds of microbes differ in their effect on the cream, and

THE WONDER OF FALLING WATER

Nothing can resist the power of water, as the wise man knew who said "a continual dropping wears away stone." Slowly but surely the stream carves a passage for itself, and, in doing so, often causes the rock on the river to put on a fantastic appearance. If we look on the left of this picture we shall see what appears to be something like the head of a white stag. It is this curious form taken by the water as it flows over the rocks that has given the name of the Stag Waterfall to this beauty spot in the Lake District, England. The poet Wordsworth, who has immortalised this waterfall, lived at Rydal, and wrote many poems about the place.

that is largely the reason why cream varies so much as it does. In Germany places have already been established where the best kinds of microbes for this purpose are grown, and can be sent by mail to the farmer for preparing his cream.

WHY ARE ANY COINS MADE OF GOLD?

There are many fairly good reasons why some coins should be made of gold. If a nation is to have a coinage made of a metal that is precious, gold is perhaps the best that can be employed. It is not too common; but, at the same time, enough of it can be obtained to meet this purpose. It has a very easily recognised appearance, and yellow mixtures of other metals can scarcely be confused with it, especially as it is so very heavy. It does not rust, and tarnishes hardly at all when it is exposed to air or moisture. It has the defect of being soft, so that pure gold coins would get rubbed away; but the addition of other metals to it make it quite hard enough to wear for a very long time.

But at the present time it seems that we shall some day cease to use gold for this purpose. For one thing, it can be shown that the more civilised nations get, the less do they employ in their business anything that is of value in itself. In old days people used cattle and the like for their money, as our word *pecuniary* —which really means cattle-ish—tells us. But the tendency at present is towards using something that shall be simply a sign, like cheques and banknotes. One advantage of this is that we shall be able to use gold, which is very beautiful, much more freely than at present, for making beautiful things with.

WILL THE MOON EVER FALL INTO THE EARTH?

This is a good instance of those many great questions in astronomy which we can answer in a way and up to a point, but not yet with certainty. The reason is that the answer to such questions depends upon the various forces that are at work in the world. If we were certain in any case that we knew all these forces, then we could be certain as to what would happen, for we know the laws of their working, and these laws are certain and never change. But, in fact, we usually know only some of the forces that are at work, and so we must be careful, because we never know whether there may not be others which ought to be reckoned with. However, judging by the forces that we do know, we are bound to suppose that some day the moon will return to the earth, which it left so many millions of years ago.

This belief largely depends upon the study of the effects of the tides which the various bodies of the solar system raise in and upon each other, and the man who has taught us more about this than any other is Sir George Darwin, the son of Charles Darwin, who taught us the history of the plants, animals, and man. We do not yet know all there is to know about the history of the moon, however, though we are practically certain that at the present time the moon is slowly travelling farther away from the earth instead of getting any nearer. But, so far as we can judge, in time it is bound to come back again.

CAN A MICROSCOPE SHOW US THE ATOMS MOVING IN WOOD?

The answer to this question is: Certainly not; but the question is well worth asking, because it serves to clear up a point that is often not understood. We are perfectly sure that if we could see the atoms or molecules of matter, whether solid, liquid, or gaseous, we should see them all in movement of one kind or another, varying according to the nature of the thing we are looking at, its temperature, its electrical state, and so forth. But, unfortunately, we cannot see these movements, and it is even certain that we shall never see them in any direct way.

People know that the microscope reveals many things which the eyes, unaided, cannot see. It is possible, with great labour and expense, to make a microscope magnify a thing ten thousand times, and it is even possible, by a very roundabout way and under special conditions, to see things—or, rather, their shadows—which are smaller than any straightforward microscope can show.

But, unfortunately, the atoms and most of the molecules of which matter is made are vastly smaller than this. We are practically no nearer seeing an atom with the highest possible power of the microscope than we are with our own eyes unaided, so tiny are the atoms. Further, there is a natural limit to the power of the microscope, because the

size of the waves that make light is a fixed thing, and is such that no one will ever see an atom. Thus, the movements of the wood in the chair, or the atomic movements of matter in general, can only be seen by the mind's eye.

WHY CANNOT WE FEEL WITH OUR FINGER WHEN IT IS NUMB?

The feeling in the finger depends, like all other feeling, upon nerves. The nerves of the finger end in the skin in a number of tiny organs, only to be seen by the microscope, which, though tiny and never spoken about, really correspond exactly to the eye and the ear. The action of the ends of nerves and the organs at the ends of them depends very much upon their temperature. That is probably the chief reason why, in the higher animals, the temperature is fixed instead of moving up and down with the surroundings.

When nerves are made cold—as when the finger is numb—they cannot receive impressions at their ends, nor conduct them if received, and so we do not feel. This can often be applied when we wish to make a little cut, or something of the sort, in a finger, or some other part of the skin. If the thing is slight and quick, it seems a very great pity to make the person unconscious, so as to avoid pain, and it is much better just to numb the part of the skin in question, if we can.

Probably all the various things that are used for this purpose nowadays depend partly for their success not only upon what they do to the nerve itself directly, but also upon the fact that they lower the temperature of the skin where applied, and so interfere with the power of the nerves to convey to the brain that something which we call pain.

WHY IS IT THAT THE BAD AIR OF A MINE DOES NOT KILL THE MINERS?

The air of many a fashionable and world-famous New York shop, or of hundreds of thousands of bedrooms every night, is far worse than that of mines nowadays. Ventilation is one of the great problems of a coal-mine, and one of the very first that must be attended to. Year by year we go on cutting the coal away, and at the present time a year's increase in the amount taken is greater than the year's total was not so long ago. Thus the miner is always having to go farther and farther away—perhaps a mile or more—from the opening; and wherever he goes a sufficient supply of air must go with him. The problem is, however, made simpler in one way, because electricity is now very often used for lighting mines, and so, at any rate, the oxygen that would have had to be used up in the burning of any kind of non-electric lamp or candle is saved.

Failure of proper ventilation is very largely responsible for explosions in coal-mines, and possibly, also, for other accidents, through the bad effect of foul air on the mind, the watchfulness, and care of the miners. Since it got to be known how important ventilation is in this respect, the standard has been much improved. An extremely expensive but very thorough way to get good air into coal-mines is to take down liquid air, which occupies very little space, and is rapidly turned into pure air ready for breathing. An arrangement has been made for carrying liquid air down by a rescuer in cases of accidents, where no one could say what kind of atmosphere he might meet in his attempt to save his fellow-workers.

WHY DOES NOT SEA-WATER MAKE FISHES THIRSTY?

Well, we might almost answer this question by another: How do we know that fishes are not thirsty? It is not at all easy to find out how much water fishes drink; but, like every other living thing, they require water, and perhaps they take a good deal. Certainly it is always at hand. We do not find that the muscles, for instance, of a fish contain higher proportions of salts than do the muscles of other animals; nor can we show any particular difference between the amount of salts in the body of a fresh-water fish as compared with the amount in the body of a salt-water fish.

We know that many fishes travel about in the course of their lives from fresh to salt water, and from salt to fresh, but no one is yet in a position to tell exactly what the fish does in these cases. It certainly is very clever to be able to adapt itself so well to such very different kinds of water. This can only mean that the organs of its body which are concerned with

keeping the composition of the blood right are able, when occasion requires, to filter an excess of salts out of it very quickly. The same is true of our own bodies, fortunately for us, as we often take food and drink containing an excess of various things which certainly must not stay long in the blood. On the other hand, we are not adapted to keep the composition of the blood right if we drink nothing but sea-water, as fishes can without harm.

WHY DOES THE DOCTOR FEEL OUR PULSE WHEN WE ARE ILL?

What we call the pulse is the beating of an artery which happens to lie just over a piece of bone at the wrist, and the beating of which is therefore very easily felt. The pulse, felt by a trained finger, gives a great deal of information. In the first place, it tells how often the heart is beating in a minute, and that needs no training to count; but it also tells how strongly the heart is beating, and how regularly. It tells whether the heart is strained or labouring or over-excited, or just beating easily, as it ought to do.

The pulse also tells what is the state of the arteries throughout the body, as to whether the muscles in their walls are tightly contracted or lax; and it also tells—though this requires long training to feel—not merely how forcibly the heart is beating, but how much pressure there is inside the blood-vessels of the body between the heart-beats. This question of blood pressure is enormously important, for it affects the working of every part of the body. The temperature can also be told from the pulse, as we read on page 3972. Thus, of all the single things that a doctor could possibly do, feeling the pulse tells him more than any other; more even, on the whole, than looking at the patient's face; vastly more than taking his temperature or thumping him, or even listening to his heart-beats.

WHY DO CHERRIES AND PLUMS HAVE STONES?

Perhaps we should have done better to ask: Why do plums and cherries have stones? These things are beautifully made for a great purpose, which is to reproduce the race of plants to which they belong. The all-important part of the cherry or plum is not the part we eat, but the kernel inside the stone. It is this that the new plant will grow from if it gets a fair chance; and the rest of the fruit exists in order to give the kernel, or seed, a fair chance. First, there is the hard part of the stone, which protects the living seed inside it from any injury, but which is so made that it can quite easily be split open when the kernel inside it starts growing. Then there is the fruity part, for the sake of which we prize the cherry or the plum.

Now, birds prize this just as much as we do, and that is why it exists. Although our liking for the fruit does the plant no good, the liking of the birds for it is just what it requires. The bird takes the cherry for the sake of the fruity part, and carries it away, and then probably drops the stone in some place where it may be possible for the seed to grow. Lastly, the skin of the cherry or plum largely succeeds in protecting the fruit from insects. So now we begin to see that there is a very good reason indeed why plums and cherries should have stones. Other fruits, we know, have no stones, but they have something else, pips or seeds, instead.

HOW DOES ALCOHOL AFFECT THE BRAIN?

Alcohol belongs to the class of those chemical substances which pass very quickly and easily through any obstacle, such as the wall of a blood-vessel, and so on. Thus, in a very few moments from the time when alcohol is swallowed, it enters the blood, and then is carried in less than a minute to the brain. There it passes out through the walls of the capillaries, or hair-like blood-vessels, and meets the matter of the brain itself.

Careful work is now being done to find out exactly what chemical changes go on when alcohol meets nerve-tissue, and especially nerve-cells. At any rate, it is now clearly proved, quite contrary to what most people used to think, that alcohol stops the action of the nerve-cells which it affects; and the constant rule about its action is that it always first affects the highest nerve-cells, those which are newest in the history of the race; and after them it affects lower types of cells in their order.

Thus, the person may be unconscious, and all the rest of his brain quite thrown out of action, and yet the lowest and oldest part of it, which directs his

breathing, may be working perfectly. Various effects of all this are seen in different people, according to the different quality of their brains. The first effect is usually to make the person appear as if he had taken something to render his brain more active, and that is why most people still call alcohol a stimulant.

The explanation of this is that the highest cells of the brain are those whose business it is to control the rest—such as those by which we talk, those that act when we laugh, and so on. Therefore, when the controlling cells and the cells whose business is judgment and keeping guard are thrown out of action, we talk and laugh more freely and quickly and easily.

It is not possible here to say much about how alcohol affects the brain when too much of it is continually taken. It destroys the nerve-cells and causes the overgrowth of the substance that lies between them. This means the eventual destruction of the mind.

WOULD THE EARTH SEEM TO BE UP IN THE SKY IF WE WERE ON THE MOON?

The answer to this question is Yes, difficult though it seems at first to understand how this can be so. Yet it can be understood. The earth is a ball, as we know, and anyone looking out from the surface of that ball gets the notion, of course, that he is in the centre of all things, and that they are hung in the sky on all sides of him. We see things up in the sky, and not down in the sky, because the earth interferes with our view. If the earth were transparent, we should see the sun, the moon, and the stars *down* in the sky, even right underneath our feet, just as we see them *up* in the sky.

This must be true not only of the earth, but also of any other of the heavenly bodies. The case is the same for all of them. This teaches us that up and down have no real meaning in themselves, but merely refer to our point of view. The earth, seen from the moon, would appear far larger than the moon does to us, and correspondingly bright. There would be no mistaking the difference between land and ocean. Through telescopes, such as we have, the largest buildings of a city could be made out. The greatest difference would be, perhaps, that an observer on the moon would so often find the details of the earth hidden by clouds. As the moon has no atmosphere, or almost none, her face is never clouded to our view; not even to the very slight extent that Mars sometimes is. But anyone on Mars or the moon would wonder what it was like to live on a world so often covered with thick clouds as ours is.

WHAT DIFFERENCE WOULD IT MAKE IF THE WORLD WENT THE OTHER WAY ROUND?

This question may have two meanings, for the earth goes round in two ways. It goes round the sun and it spins round on its own axis as it does so. If either or both of these movements were reversed, there would be no consequences of any particular importance. We should still have night and day, and the seasons, which are the results of the present movements, as we have them now. Of course, serious consequences would happen if the earth's present movements were suddenly reversed, but that is another question.

The direction in which the world goes round matters a very great deal in the attempt which we are bound to make to interpret the world in which we live and the history of it.

DOES IT HELP US TO KNOW THE WAY THE WORLD TURNS ROUND?

The fact that the sun, the earth, and those planets we can observe all spin upon themselves in the same direction, and that all the planets revolve round the sun in the same direction, which is also the direction of their spinning, is of vast importance in guiding us towards true notions of the history of the solar system to which we belong.

This great fact teaches us that all the motions we observe in the solar system have a common origin. They are, doubtless, the present representatives, so to speak, of the spinning of the spiral nebula from which the solar system was formed. There are one or two apparent exceptions to the rule, notably the motion of one of the moons of Saturn, which revolves around the planet in the reverse direction. Such a remarkable case makes it probable that this moon has a special history, and it may very likely have once been independent of Saturn, and then caught by the planet's power of gravitation.

The next Questions are on page 4437.

THE RIGHT WAY TO PLAY LAWN-TENNIS

Beginners sometimes hold their rackets like this, but it is quite a wrong way for any stroke; they should be held at the end, just above the button.

This is the correct way to hold the racket to hit the ball when it comes to the right hand of the player. Note the position of thumb and fingers, and also of the head of the racket.

In the correct position for the ordinary underhand service the left foot is in front, and the racket is swung back in a straight line with the arm as shown.

Here the racket is swung back ready to put a screw service on the ball. The strings cut the ball from left to right as the racket comes forward.

In this picture we see the right grip of the racket for the backhand stroke, used in hitting a ball coming on the left hand of the player.

This is how to perform the "round-arm smash," a useful stroke with which to "kill" weak balls just over the net. Notice the free action, which should always be striven after in hitting.

This is the wrong way to hold the racket for a backhand stroke. The position is cramped, and the thumb should not be in front of the handle.

THE GAME OF LAWN-TENNIS

CONTINUED FROM 4250

LAWN-TENNIS is an outdoor summer game, which is becoming more popular every year among both boys and girls. Only two or four players are needed for a game, and it can be played on the garden lawn if the latter is sufficiently large and level. If we are not fortunate enough to possess such a lawn, we can play in the parks, most of which have specially prepared and marked-out tennis-courts, with nets provided. Should we wish to use our own lawn, the grass must first be cut quite close to the ground and well rolled. The court is then marked out with straight white lines about two inches wide, in accordance with the plan and the measurements in the illustration.

It is not necessary for the beginner to pay a very high price for a racket, but he must see that the strings are taut, and the handle comfortable to grip. Its weight should be twelve ounces for a boy or girl of thirteen, and it should balance at the screw. A game between two is called a "single," and a game played by four is called a "double."

We will first deal with the "single" game. Before starting, the net must be raised to the height of three feet in the centre, and the players should toss for choice of side or service. If the winner chooses the side, the loser serves, or the winner may elect to serve, and then the loser chooses the side. The object in the game is to hit the ball into our opponent's court so as to make him fail to return it into our own court. Every time he fails it adds to our score, and every time we fail it adds to his score. The server must succeed, too, in hitting the ball over the net into the service court in one of two strokes, or his opponent scores a point.

The first point won counts 15, the second 30, the third 40, and the fourth a game. When both players reach 40 it is called "deuce," and a player does not add a game to his score until he wins two points in succession, the first being won when the ball is served from the right-hand court, and called "vantage in." It is "vantage out" if he loses the first point, but "deuce" again if he wins the next point. The server must stand behind the base line to the right of the centre, and throwing up or dropping the ball with the left hand, according to whether serving overhead or underhand, strike it with the racket before it reaches the ground, so that it shall fall in the right-hand service court on the other side of the net. Should the ball fall into the net, or outside the service court, the service is called a fault, and he tries again. If this service, too, does not fall into the service court, the receiver scores a point.

The receiver should stand somewhere near his base line ready to hit back the ball while in its first bounce. In this first stroke he is only allowed to hit the ball in this way, but after this stroke both players may hit the ball before it bounces, or "volley" it, as it is called. If the player lets the ball bounce a second time, his opponent wins the point. The receiver may return the ball into any part of his opponent's court, and the server, in returning it, may this time hit it into any part of the court. The two players hit the ball to and fro over the net to each other until one fails to return the ball within the opponent's court.

When the first "fifteen" is lost and won, the server delivers his second service from the left-hand side into the service court diagonally opposite him, and the receiver also moves to his left-hand side.

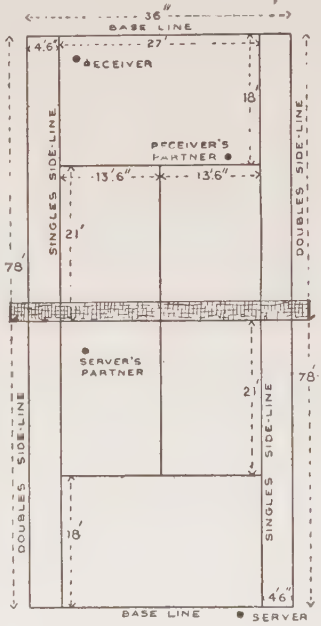
On the completion of the first game the receiver becomes server, and the players serve in turn until one of them gains six games, which count as one set. Should both players count five games, they may decide to play on until one of them is two games ahead of the other.

It is most important that we should hold our racket correctly. For serving and hitting the ball when on our right hand—the forehand stroke—we should grip the racket firmly at the end, the button just projecting beyond the little finger. For hitting a ball coming to our left—the backhand stroke—it is best to move our thumb so that it points along the length of the racket, and with some players the latter is slightly

twisted round in the hand. The essential thing to remember, however, is that the centre of the racket should meet the ball at right angles.

There are two ways of serving, the underhand and the overhead. In the easier underhand service the racket should be held firmly in a straight line with the hand and arm from the shoulder, and swept like a pendulum by the right side of the player, hitting the ball, which must be dropped into its path from the left hand. The movement should not stop immediately the ball has been struck, but the racket should follow the ball's path. It should, indeed, be a general rule in playing that the bat follows through its stroke, as much more certainty is given to the stroke, and a much freer action is thus gained.

In the overhead service the racket is carried behind the head, the shoulder being back and down; the ball is thrown up above the right shoulder three or four feet, and the racket is swung over so that the centre of the racket hits the ball as high above the head as possible. The left foot points to the net, and the right foot is almost at right angles to it, and the body should also be slightly turned away from the net. The greater weight of the body is first on the right foot, being transferred to the left as the ball is hit. The racket should follow through towards the left knee. We should rather make the mistake of sending the ball over the service line than hit it down into the net. A ball falls naturally, and we should first hit at a spot a yard or so above the top of the net. The power of imparting twists, swerves, and screws to the ball come naturally to most players after a few months' practice, and are obtained by drawing the surface of the strings across the ball as it is being hit. The server should make certain of sending an accurate second service, should the first one be a fault. Variety of pace and placing should be aimed at more than mere fast pace.



Plan of a lawn-tennis court

The opponent, or receiver, should stand at the distance behind the service line where he expects, from experience of the server, that the bouncing ball will have begun to drop to the ground. He should avoid having to hit the ball as it rises to the top of its bounce. Half-volleys in tennis are the most difficult balls to return, and to be forced to take a ball on the half-volley is generally a sign that the player is in a wrong position—his aim should be to avoid having to play this stroke. He should be satisfied with getting the service, especially a hard one, back with a good length, that is to say, to fall near the base line.

Every player should hit the ball with a firmly-held racket, keeping his arm as free as possible. His racket should meet the ball rather than let the ball meet the racket. He should be sure to time the ball accurately, and put weight into his stroke from his shoulder and body, and he should keep his eye on the ball until it is right on the racket. If his opponent is running up to the net, it is good policy to lob or hit the ball gently up over his head and out of his reach. Beginners should hit the balls after they have bounced, and make sure of a good length and accurate direction. Later they should practice volleying, and this can be done against any blank wall when there is no opportunity for a game.

In volleying, the beginner should always try to take his low volleys with the head of the racket above the wrist, and to get his feet in the right position, thus: for a low forehand volley his left foot should be forward, for a backhand volley the right foot. For overhead volleys careful watching is necessary, and easy balls hit as hard as possible so as to "kill" them.

In play we must aim at hitting our balls well out to the base lines rather than gently just over the net. We must always remember, too, to start at once for our ball, and not wait until it is over the net before going for it.

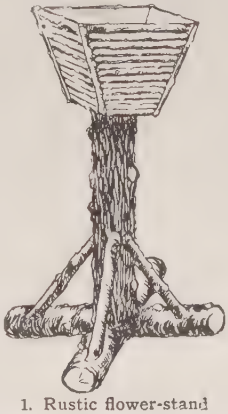
In tennis we must learn to be very nimble indeed, and to recover our balance and position at once, especially when we have run back to take a lob over our head. Finally, to play well, it is absolutely necessary in such a quick game as tennis to concentrate one's whole mind on the game, and never to play slackly for an instant.

There is no difference in the scoring in a "double," but a larger-sized court is used, and the side lines of the single court are only used as boundaries to the service courts. Partners serve in turn thus: W and X are playing Y and Z. W serves, then Y, then X, and lastly Z. Z stands in the right-hand court for W's first service, while X is on W's left. For the second point W changes sides in his court with his partner, X, and serves from the left-hand court to Y. On the completion of the game W stands to the right-hand side of the court to receive Y's first service. Only the server and his partner change their positions. In "doubles" it is the object of each pair of partners to beat the opposing pair, and they must help each other to this end as far as possible. It is best to decide that each should have the balls that come on his side of the centre line. Another way to play, which is not quite so useful, is for one player to take the balls that fall near the net, and his partner those that fall near the base line.

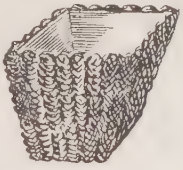
EASY AND USEFUL RUSTIC CARPENTRY

It is less expensive to make many articles of rustic carpentry for the garden than it is to purchase the factory-made or shop-made articles that serve the same purpose, and that do not look nearly so appropriate to their surroundings. If we look at the large pedestal flower-box in picture 1 we can see that this work is eminently attractive in appearance, and it is comparatively easy to do. For the flower-box in question we first make the box itself. This is made of plain boards—four of them—from any old packing-case that we are fortunate enough to possess. The four should be, say, 15 inches wide at the top, 15 inches deep, and an inch thick. But the sizes are not important so long as all four pieces are the same size.

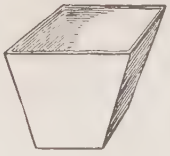
The bottom should be square and not less than one inch thick, its size being suitable for the bottom or smaller end of the box. Its edges should be trimmed or planed to a bevel so as to fit the sides accurately. We should make four or five half-inch holes in the bottom—not in the centre—to carry off the water which may accumulate in the box, and which, if left, would turn the earth sour and kill any growing plant. This part, when made, will be as seen in picture 3.



1. Rustic flower-stand



2. Pine-cone decoration



3. The plain flower-box

4. Virgin cork decoration

Now we want the centre post, which should be a piece of natural wood from three to five inches thick and about three feet long. It should be sawn off straight across both top and bottom. If there is any difference in the thickness, we make the thinner end the top. We put the box that we have made on the top of the post, in the centre, and put several good long nails right down into the post. About three nails, each five or six inches long, will do well enough. Next we put two cross-pieces for a base, checking them in the middle if necessary. These pieces should be about the same thickness as the upright post, but may be a little thinner. Long nails are put right through where these pieces cross up into the bottom of the post. Now we nail on the supporting pieces which join the feet and the post, choosing bent pieces that lend themselves to our purpose; or, if the pieces happen to be straight, we must saw them off at one angle, thereby making it easy to nail them on at the spots where they fit.

We can now decorate the outside of the box. We nail split branches, about one inch thick, round the top and bottom edges of the box, and up each of the four corners. The sides of the box we can fill in with smaller split branches, after which we have, at no expense and with little trouble, completed a very presentable piece of garden furniture that will hold a large plant. In picture 2 is shown a box the sides of which are ornamented with pine-cones split in two halves lengthwise, and in picture 4 is seen a box with virgin cork ornamentation. Either of these is easily applied instead of split branches. Before putting a plant into our flower-pot, we ought to put at the bottom a layer of stones, broken bricks, or pieces of broken crockery, as this enables moisture to drain from the roots. No plants are healthy if there is no means by which the water may run away from their roots.

Of course, if we use the flower-stand as described, it must be set in a place where water dripping through the holes will do no damage. In a tiled conservatory or porch, or in the open, it would be all right, but in a drawing-room or living-room it would probably spoil the carpets. If we want to change the plant frequently, we can put a square-shaped flower-pot inside the flower-stand. Then, when we wish to remove the plant, we simply take this inside pot and put in another. The last picture illustrates a rustic chair made of oak branches, the crookedness of which makes them very suitable for chair work. After reading the description of the flower-stand, any boy will be able to make the chair without detailed particulars, and if he is successful in this he may go on to tables, garden seats, and even rustic summer-houses, all of which are both picturesque and useful. The best time for work of this sort is in the autumn, when growing wood is drier than at other times, for it then contains much less sap. It must be remembered that wood with a covering of bark is apt to be the home of insects, so that in time the bark falls off as the wood dries. For this reason it is very much better to use wood that has lain exposed until the decayed bark has fallen off. By doing this we avoid the unsightly appearance that rustic work attains when the wood sheds its bark.

5. Rustic chair made of rough branches

WHO ARE THESE PEOPLE?

A CHARACTER PUZZLE GAME FOR BOYS AND GIRLS

IN the following game the character of some persons mentioned in THE CHILDREN'S ENCYCLOPÆDIA is described. Someone reads the description aloud, and the boy or girl who gives the greatest number of correct names wins the game. It is best to write the names on a slip of paper, so that everyone who is playing has an equal chance. The solutions will be found on page 4458.

THE MAN WHO PREACHED HAPPINESS

1. There was once a handsome boy who loved fun and amusement. He thought of little else except how he and his companions could enjoy themselves. Yet he was generous, and often gave gifts to others. Animals knew he was fond of them, for his horse showed pleasure at his appearance, and birds came at his call to perch on his shoulders. As he grew older, he had more serious thoughts of the world about him, and puzzled over his own existence till he came to realise that love—love to mankind, to the birds, and the beasts, and the flowers, and, above all, to the good God and Father of all—was the thing of supreme importance. So he refused to dress in costly garments. He gave away all he had, and went about speaking kind words and doing good actions, trying to teach people the real secret of happiness.

A RULER OF ENGLAND

2. As we look at the portrait and think of this man, we can understand how people ran to do his bidding, for he said what he thought right, and to him speech meant action. The man knew his own mind and his own power. He possessed no polished manners or courtly graces, but he had a sturdy self-reliance and strong will-power that was easily stirred to right an injustice or to defend his home, his country, or his religion. Yet, like other men of strong character, he showed a tender heart to the weak and young, made a companion of his little granddaughter, and was very good to his feeble old mother. Some people say he was cruel, forgetting that leniency is sometimes great unkindness, and that a surgeon often has to inflict pain in order to cure.

THE MISER WHO HATED A GOOD MAN

3. We picture before us a repulsive man, with black hair, ugly face, and claw-like hands. He grabs all the money he can and hoards it up. His heart is full of envy and spite against those who are generous. He once loved his wife; but now no one, not even his daughter, really loves him, because, though he has the power to do good that money gives, his mind is getting narrower and his soul is becoming dwarfed. He lends money at high interest, which he extorts to the very last farthing. Some people have been unkind to him, and have despised him for his nationality and race; but, instead of pitying and forgiving them, he becomes more self-centred, and harbours revenge. He tries to outwit others by cunning and lying, hardens his heart, refuses mercy, and plots against the life of another. But when truth and goodness are too wise and too strong for him, he shows himself an abject miser, and says he would rather die than give up his worldly wealth.

THE MAID WHO LED AN ARMY

4. There was once a maid who lived in the meadows tending sheep, whose eyes rested on the beauty of the blue sky and soft, snowy clouds, and whose ears listened to the song of the lark and the murmur of the brook. Her thoughts were beautiful, too, and pure as an innocent child's. She saw lovely visions of good and glorious beings who talked to her and helped her to do right. Her country had been conquered by the foreigner, and she mourned the fate of her dear native land. One day, when she was musing in the fields, it seemed to her an angel called to her to arise and save her country. Now, she was only a simple, ignorant maid, yet from that moment so strong a determination to help her country and secure its freedom filled her whole mind that she banished all thought of herself. And she was steadfast to her resolve, so that battlefield, hardship, insult, suffering, and imprisonment were powerless to break her spirit, until the enemies of her country wickedly burned her at the stake.

THE GIRL WHO NURSED HER DOLLS

5. A little girl used to be very fond of her dolls, and pretend that they were ill and wanted nursing. She loved animals, too, and liked nothing better than tending sick and feeble creatures. As a child, she cared for her dolls and pets; as a woman, she spent her energies in nursing. Brave and merciful, she went hundreds of miles away from home to care for the wounded on the battlefield. She found things in a terrible state. Soldiers who had been badly injured by shot and shell were lying on the hard, cold ground. The attention that they received was of the roughest. They were dying in scores for the want of proper nursing and nourishment. With an energy that was simply wonderful, she set herself to alter it. She succeeded in her purpose, and through her great efforts she has robbed modern warfare of many of its terrors. She showed herself unselfish and generous, for the money people sent her as a present she gave to found a training home for nurses.

THE SHEPHERD BOY OF THE EAST

6. There lived in the East a shepherd boy who made sweet music and wrote lovely poetry. His mind was filled with great ideas about the goodness of God and the beauty of Nature. At times he was happy and glad to be alive; but sometimes he grew depressed and melancholy, and prayed God to overcome his enemies. Yet his spirit always rose, and he became more hopeful. He was capable of doing mean and wicked things, but he repented so bitterly that we are told he was a man after God's own heart.

SOME PUZZLE RHYMES AND VERSES

All kinds of puzzles may be worked into rhymes and verses, and it is a very interesting pastime for a rainy day or for a dull evening to solve such puzzle rhymes, and still more interesting to make up original verses of this kind.

For instance, here is a puzzle rhyme:

What is the word referred to in this little verse?

First a *c* and *a t*, last *a c* and a *t*,
With a couple of letters between,
Form a sight that our eyes are delighted to see,
Unless in their sight it is seen.

Here is another similar verse telling how to spell a certain word:

Inscribe an *m* above a line
And write an *e* below,
This woodland flower is hung so fine,
It bends when zephyrs flow.

Dr. Whewell, the great mathematical scholar, once wrote out the following four lines, which can be read as a verse of rhyme. Let us see if we can understand it.

O O N O O
U O A O O I O U
O N O O O O M E T O O
U O A O I D O S O
I O N O O O I O U T O O

When we have solved this curious puzzle, we should try to invent some other clever problems of the same kind.

BURIED NAMES

Names may be buried in verses, and it is very interesting to dig these out. In this verse of four lines are buried the names of four animals—that is, the names of the animals are found in the verse spelt properly, the letters running one after the other in their right order.

Poor wretch! a moisture filled his eye,
"Do not rebuff a lonely boy,"
Said he, "If ere I sink and die
Your smile, O! pardon will be joy!"

Here is another verse in which are buried the names of eight British poets.

The sun is darting rays of gold
Upon the moor. Enchanting spot!
Whose purple heights, by Ronald loved,
Up open to his shepherd cot.
And sundry denizens of air
Are flying, aye, each to his nest;
And eager make at such an hour
All haste to reach the mansions blest.

Who are these eight poets?

In this verse there are hidden the names of four fruits. What are they?

Go range through every clime, where'er
The patriot muse appears,
He deeds of valour antedates,
His ban an army fears.

ARITHMETIC IN RHYME

Here are some arithmetical problems in rhyme, which we shall find quite interesting to solve. First of all, who can do this?

Twenty-seven with three nines
You and I can score,
Anyone on other lines
Can extend them more;
Who can write them to be seen
Equal only to sixteen?

A man being asked the ages of himself and his wife when they were married, replied:

When first the marriage knot was tied
Between my wife and me,
My age as oft repeated hers
As three times three does three;
But when ten years and half ten years
We man and wife had been,
Her age came then as near to mine
As eight does to sixteen;
What age was hers, what age was mine
When we were wed, from this divine.

This is a little problem that is quite easy when you know just how to do it.

A third of six behind them fix
A third of six before,
Thus make two nines, when all combines
Exactly forty-four.

A little boy asked his father how old that parent was, to which the father replied:

I was twice as old as you are
The day that you were born;
You will be just what I was then
When fourteen years are gone.

What were the ages of the father and son?

RIDDLES IN RHYME

Some very ingenious riddles can be asked in rhyme. Here is one:

With letters three indite my name,
Add one to show what I became,
Or try to tell what brought me fame.

The name is that of a well-known literary man.

Here is another conundrum in verse:

Often talked of, never seen,
Ever coming, never been,
Daily looked for, never here,
Still approaching in the rear.
Thousands for my presence wait,
But, by the decree of fate,
Though expected to appear,
They will never see me here.

What is the solution of this?

SOME CHARADES

It is quite an active mental exercise as well as a pleasant amusement either to write a charade in the form of a rhyme or to solve one. In a charade, as we of course know, a word is taken, each syllable of which has an independent meaning, as in the name Campbell. Here are one or two clever charades:

My first is a circle, my second a cross;
If you meet with my whole, look out for a toss.

My first makes company,
My second shuns company,
My third assembles company,
My whole puzzles company.

My first I hope you are,
My second I see you are,
My whole I know you are.

The solutions to these Rhymes and Puzzles will be found on page 4458 of this book.

WHAT TO DO WITH SPOOLS AND BRICKS

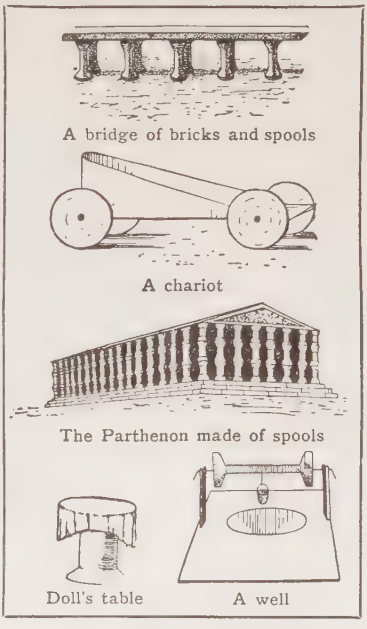
If we save all the empty thread spools and put them into the playbox, we can spend many happy hours playing with the spools and a box of bricks. When not in use, we can keep the spools on a piece of string to prevent them from rolling into out-of-the-way corners. One of the most interesting things we can make is a little bridge to span a river.

First we must pick out ten fairly long spools to form the supports of the bridge. These spools we must soak in hot water to loosen the paper labels, which can then be scraped off. We place the spools on end in five couples at equal distances apart, and join them up with long bricks, or a strip of card, cut the width of the two spools, which is long enough to span the river and rest on the banks. We can build up bricks to support the ends. The card can be nailed to the spools with tin-tacks near the edges, and if we care to make parapets, two strips of card can be bent at right angles and the bent part glued down over the heads of the nails. This little bridge will be fairly substantial, and real water can pass under it, while over the top we can run a toy motor-car or train.

If we place four long empty spools on the table, two and two, on their sides, they suggest to us the possibility of making a pair of roller skates. A piece of thick wire must be bent round each end of the narrow central part of a reel, and a little sheet of tin, such as we can get from a preserved fruit or meat tin, should be shaped like the sole of a boot and attached in place by the wire coming up from the reels. Black tapes can be used for straps, and drawn under the tin near the wheels. A small glass dish, such as that in which potted meat is sometimes sold, might be tied on to the tin, filled with flowers and placed on the table, where it will make a novel flower-vase for pansies or other short-stalked flowers.

Another little toy, a miniature chariot, can be made with two long spools, as long as we can get, placed on their sides, one in front of the other. On the central part of the spool we lay a flat piece of wood from the box of bricks, or a piece of cardboard. This we can secure to the centre of the spools with twine. A sloped piece of card is then glued round the front of this, as shown in the picture. We can then make the chariot bright by covering it with silver paper. This serves as a very pretty holder for a glass of flowers. In a similar way, a truck, such as railway porters use, can be made by leaving out the card at the front, and adding parts of wooden skewers for handles. Three long, narrow spools can be placed one on top of the other in piles, arranged eight in a row in front, eight at some distance behind in line with the others, and the intervening space along each side filled with fifteen piles. What we are making is a model of the Parthenon at Athens. Having built up the columns, we place a row of bricks along the summits, place triangular pieces of card at each end to support two large pieces of card which will serve for the roof, and we have a rough copy of the Parthenon.

There are plenty of old churches in London and other cities built in this Doric style, which we can also imitate. A church steeple ending in one spool, with a wire or pin weathercock inserted in it, is simple to construct. Another thing we can build with our spools is a tower, and for this we shall want plenty of long, narrow spools. After making a brick foundation, we place a dozen or more spools close together in the form of a circle, and lay a disc of brown paper or card between each circle until seven tiers are built up, using fewer spools as we ascend. If we are skilful enough to place some of the discs a little on one side, we can imitate the tilt of the Leaning Tower of Pisa, shown on page 305.


A bridge of bricks and spools

A chariot

The Parthenon made of spools

Doll's table

A well

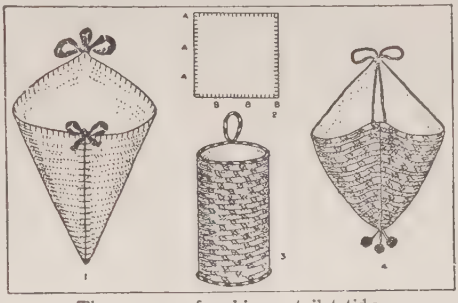
Other spools besides cotton-spools may be available for making small toys. The spools on which wire is wound make nice wheels for a child's go-cart or mail-cart. The body of the cart is made of wire bent in a similar way to that used in making doll's furniture, described on page 1717. If a piece of white paper be pasted over one end of a short spool, we have a table for the doll's house.

We can make quite an elaborate toy in the following way. A wooden skewer, cut to a suitable size, is wedged into the central hole of a long spool, and is supported at the two ends in grooves of two upright pieces of wood which are glued to a piece of card with a circular hole in the middle. Two long, stout pins are hammered into the ends of this improvised wheel, and bent at right angles to form two handles used in winding and unwinding a thread rope, to which a little bucket is attached. A thimble, with a piece of wire encircling the rim and forming a handle, does nicely for this. Twine or coarse sewing thread will do for the rope, which should now easily draw up bucketfuls of water out of a tumbler over which the little well-head may be placed.

HOW TO MAKE OUR OWN TOILET TIDY

THERE are many ways of making a toilet tidy; we are going to describe three very pretty patterns which are quite easy and inexpensive to make.

That shown in picture 1 is made from a piece of canvas about six inches square. The edges of the canvas are worked with button-hole stitch in silk or bound with a pretty-coloured ribbon. When we have done this, we must sew together neatly the two sides marked A and B in picture 2, tie a dainty bow of orange or pale blue ribbon on it, and our toilet tidy is complete. If we like we can work a daisy or some other flower on the top and the two sides.



Three ways of making a toilet tidy

Another kind of tidy is made from an old cocoa-tin, covered with silk and crochet work.

We should choose a small can, line it all over with silk, and then cover the outside with crochet work. Strawberry or a coral shade of pink gives a pretty effect.

When the tin is lined, we must get some thick silk and crochet a strip large enough to go right round the tin. The pattern of the crochet should be three treble, three chain, three treble, three chain, and so on. We learnt how to crochet on page 1348. Then carefully sew it on to the lining, and edge top and bottom with a fancy cord, making a loop at the top by which to hang it up. Of course, the silk and cord must match the lining.

The finished toilet tidy is shown in picture 3.

The third, and perhaps the prettiest, pattern of all is this. Crochet a square in white cotton, and line it with very soft pale pink silk, so that one side is crochet and the other silk. Then crochet two pieces of chain stitch long enough to go across from corner to corner, and sew it on. Then sew three pink "bobbles" on to the end of three tiny crochet chains, and fasten the other end of the chains to the bottom of the tidy. If they are too big, the effect will be spoilt. The little crochet bow, shown in the last picture on this page, is fastened on by the crochet needle, and the crochet chain extended, taken through the front of the tidy, and fastened off by the bow at the top. This is to act as a support to the crochet, which, being so soft, would otherwise fall down.

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF SEPTEMBER

IF the seeds of the globe beet were sown in good time in the spring, the crop should be ready to lift and store. It is necessary to lift these vegetables very carefully; they must not be pricked or cut, or the skin in any way broken, or even the tap root broken off short, or the juices will escape, and the vegetable deteriorate. The long beet is a somewhat later crop.

As soon as we have cleared away a crop, we may dig over the ground deeply, so as to let sun and air do their wholesome, sweetening, and purifying work.

Another gardening operation that will need attention is the earthing up of the celery. Some rows may already have been done, but the later rows will now be ready. The best time to choose for the work is while the soil is still slightly moist from rain; if the weather is dry, however, a thorough watering should previously be given, pouring the water close down beside the plants.

The scarlet runner beans will probably be producing more pods than are needed for present use, and, rather than leave them to exhaust the plant, they may be picked and preserved for winter use. This is a very simple matter, and all we need is a jar. We put a layer of beans and then a layer of salt, alternately, until the jar is full, and then fasten it down. Before use, the beans must be well soaked in water to extract the salt from them.

There may still be potatoes to lift, and not only to lift, but to store. For potatoes, for carrots, and also for beet, as convenient a method as any is to make a *clamp*, so long as it is well made and capable of keeping out the winter's frost. We place our roots, or our potatoes, under straw and soil. First of all we dig a round pit in the ground, say, some six inches deep, and line the bottom and sides with a good layer of dry, clean straw. Next we make a heap of our potatoes or our roots of beet, and, later on, of carrots. Over these we must place a thick covering of straw, and on the top of all a layer of soil about seven inches thick. When the soil is in place, the back of the spade should be used to beat it down tight and close, and probably that seven inches will be greatly reduced and more soil will need to be added to it.

But we should not quite cover the top; a hole or two should be left for a time, because the moisture in the vegetables and soil must have an escape. When the real wintry weather sets in, we can put some extra straw into these ventilation holes. We must not forget, when storing our potatoes, to look them well over, and to throw out any that show signs of disease. Potatoes once lifted from the ground should be kept as dry as possible, and should not be exposed to the light longer than is necessary.

If beet, parsnips, and other *root* crops are not stored in clamps, but are kept in some cellar or outhouse, some sand should be

placed between them to prevent their drying and shrivelling. It is important to remember that the frost must never be allowed to reach them.

At this season there will be an abundance of rubbish in the garden, old pea-tops, weeds, cabbage-stalks, and much else. If we are allowed a bonfire, this is not only the best means of getting rid of it but also of turning it to good account, for the ashes of vegetable matter contain many things that are necessary for living plants to have; so that all the ashes left should be dug into the soil.

It is often a little difficult to decide if the apples and pears should be gathered or hung a little longer. Much depends, of course, upon the variety, and a good test is to cut one of the apples in halves and examine the pips. Are these quite ripe and black? If not, the fruit has not fully matured; but if they are quite coloured a uniform black, and the fruit severs easily from the branch, then we may take it for granted that it is ready for storing.

The great point in fruit-gathering is to see that it is not bruised. Wind-falls should be kept separate, and should never be allowed to lie longer than can be helped on cold, dew-laden soil.

Of course, they are for immediate use, but they are much better if carefully treated, gathered up each morning and laid out separately. Steps are very useful for gathering the low fruit on the outside of a tree where it is difficult to reach from the ladder.

It is quite time to prepare the ground by digging, not forgetting to add some stable manure, if we contemplate planting fresh fruit-trees next month or the month after. It is a good plan thus to prepare the soil in readiness some little time in advance of planting, as this gives it the chance to settle.

MAKING A CHEMICAL WEATHER-GLASS

We may have seen a curious-looking weather-glass in the form of a round tube containing a liquid which becomes clear or cloudy, or flaky or spotted, so that we can tell what sort of weather we are going to have. Some weather-glasses are really very good, and are very easy to make. First we require a glass tube ten inches long and three-fourths of an inch in diameter.

We should purchase at any chemical instrument dealer's shop a test tube of this size, for which we may have to pay only a few cents. We can fasten it to a flat piece of wood if we wish to hang it on the wall, or, if we wish it to stand, we can make a round base with a round hole in the middle, so that the tube can go into it about one inch.

The method of making the wooden frame or base is not important, and is only for the purpose of steadying the tube. When we have done this, we must have a prescription made up at the druggist's. Here it is:

Camphor, two drams.
Potassium nitrate, half a dram.
Ammonium chloride, half a dram.
Absolute alcohol, two ounces.
Water, two ounces.

The price of this mixture will be somewhere between fifteen and thirty cents. If the solid ingredients do not dissolve readily, they may be assisted by shaking the bottle, and even by putting the bottle in a little warm water, taking care, however, that more water is not allowed to get into the bottle. When the mixture is properly dissolved, it should be poured into the weather-glass tube that we have already prepared.

Then we put a cork in the top of the tube, to keep out any dust that might get in. The weather-glass is now ready for its work, and may be hung up or placed wherever we wish to have it; but it is best placed exposed to the north and in a shady place, where it cannot get the direct rays of the sun. The appearance of the liquid will change when the weather is going to change. Here are the indications:

Clear liquid—Bright weather.
Crystals at bottom—Thick air, frost in winter.
Dim liquid—Rain.
Dim liquid with small stars—Thunder.
Large flakes—Heavy air, overcast sky, snow in winter.
Threads in upper part—Windy weather.
Small dots—Damp weather, fog.
Rising flakes which remain high—Wind in upper air.
Small stars in winter on bright, clear, sunny days—Snow in a day or two.

It will be well if we write out on a neat card all the indications, so that anyone examining the weather-glass will have the key to the meaning of the different appearances.

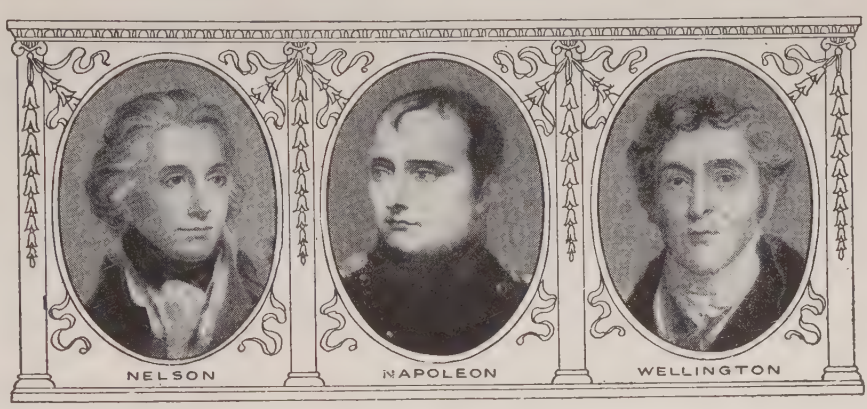
HOW THE FARMER ENLARGED THE FOLD

We read on page 4248 of a farmer who had a fold made of fifty hurdles that would hold exactly a hundred sheep. Later he bought another hundred sheep, and this made it necessary that he should double the size of his fold. In order to do this he bought only two extra hurdles, and the farmer's friend who went to market with him was sure that he had made a mistake, for it seemed impossible to him that the size of a sheep-fold made up of fifty hurdles could be doubled by using only two extra hurdles. But the farmer was quite right. In the first place he had made his fold a long, narrow enclosure, with twenty-four hurdles on each side and one hurdle at each end. Then to double the size of the fold he moved one side farther from the other and placed two hurdles at each end instead of one, by this means exactly doubling the size of the enclosure.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4451

WELLINGTON'S FIRST MEETING WITH THE FRENCH

While still a boy, Wellington had his first encounter with the French, as shown in this picture by Mr. George W. Joy. After attending some classes at Paris, he was sent to the military school at Angers, in France, to complete his education and prepare him for the English Army, which he was destined to enter. So far as is known, Wellington showed no particular ability at school and gave little promise of the great part he was afterwards to play in defeating the flower of the French Army, and in the crowning the conqueror of French generals, who had kept Europe in turmoil for twenty years.



NELSON, WELLINGTON, NAPOLEON

THREE MEN WHO CHANGED THE WORLD

CONTINUED FROM 4318

JUST a hundred and forty years ago, a baby was born at Ajaccio, on the island of Corsica, in the Mediterranean Sea. He was destined, as the saying goes, to turn the world upside down. His family name was Buonaparte, though when he became famous he took to spelling it Bonaparte, which is an Italian name; his Christian name was Napoleon.

During more than twenty years of his life Bonaparte was going to be at war with the British. It is odd to think that it was just a chance that he was not born a British subject. For, a little while before, the Corsicans had rebelled against their masters, the Genoese, and the leader of the rebels asked the English to come and rule over them, but the English refused.

Then the Genoese sold their claim to rule over Corsica to the French, who set up their own rule there, and it was only a few months later that Napoleon Bonaparte was born.

When he was old enough, he was sent to the French Military Academy to be trained to become an officer. The young Corsican, with his Italian blood, did not get on very well with the French boys, who little thought he was going to be a national hero to the French afterwards. But he succeeded with his studies, and was particularly fond of two subjects—mathematics, which are very necessary to make anyone a master of one part of the art of war; and the history of the great conquerors, and how they were victorious in their wars, so that he learnt the secret of their successes.

It was just about the time when the French Revolution was beginning that the little, thin, olive-skinned Corsican became a lieutenant in the artillery. When the French had cut off their king's head, and declared war against all the crowned monarchs of Europe, the Royalists, who would not obey the Republicans and Robespierre, got possession of the harbour of Toulon, and a British fleet came to help them.

But the Republicans sent an army to besiege Toulon, and it was the clever plan of the youthful lieutenant of artillery which enabled them to capture it, and then it was no longer possible for the British fleet to stay in the harbour. But young Bonaparte soon got into trouble, in spite of what he had done, because he had made friends with Robespierre's

brother; and when Robespierre was overthrown, the people who had been his friends were held in suspicion by the new Government.

Although Bonaparte was only twenty-five, he had found out by this time that he understood more about managing armies than most other people; yet he thought there was so little chance of his rising to hold a high command in the French army that he wanted to go away to Turkey and help the Sultan to make a great army there. However, he got his chance after all, for the Directory, as we read on page 2274, were afraid of losing their power; and one of them, named Barras, thought that if he got that clever young artillery officer on his side, they would soon be able to overcome all resistance that might be offered to them.

That is how Bonaparte got command of the troops, and crushed the revolt against the Directory in Paris. He did it so cleverly that the great War Minister, Carnot, saw at once that he was fit to hold the very highest commands, young as he was. The Directory wanted a general whom they could use to prevent anyone else from upsetting them, but they did not imagine that their own general was going to become their master. So, as the French wanted to drive the Austrians out of their possessions in the north of Italy, and Bonaparte had made a very skilful plan for doing it, he was sent off to command the army in Italy.

Before he went he had just time to marry Joséphine Beauharnais, a lady with whom he had fallen violently in love. A week later he was well on his way to the war, and then he began to win victory after victory in a way which astonished everyone. For when Bonaparte was in command, the soldiers soon learnt that they could do things which everyone else supposed to be impossible. It is easy enough for a man to walk twenty miles in a day, but it is a very difficult thing to march several thousand men with all their stores and supplies and artillery over that distance, and to do it day after day.

Bonaparte was so skilful in moving great masses of men swiftly over a great deal of ground that he was constantly appearing before the enemy, ready to

BONAPARTE AT THE MILITARY SCHOOL AT BRIENNE, TO WHICH HE WENT AT TEN YEARS OLD

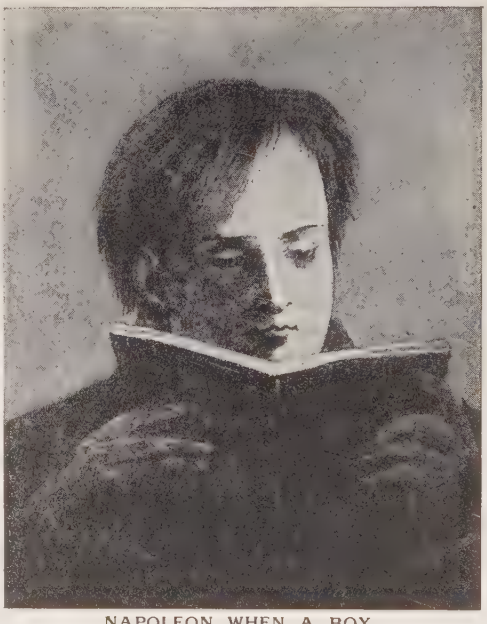
NELSON ABOUT TO JOIN HIS FIRST SHIP

When Nelson was only twelve years old, his father wrote to an uncle, who commanded a war vessel, to ask if the boy might join the ship. "What," replied the uncle, "has poor Horatio done, who is so weak, that he, above all the rest, should be sent to rough it out at sea? But let him come, and the first time we go into action a cannon-ball may knock off his head, and provide for him at once." It was scarcely a promising introduction to naval life, but Nelson eagerly grasped the opportunity of becoming a sailor, and here the artist, Mr. George W. Joy, shows us the boy bidding good-bye to his grandmother before setting off for his first ship.

attack them before they could occupy strong positions; and so, though the Austrian armies were much larger than his, he would manage to hurl his whole force against one part of the enemy, and beat them utterly before the rest could come to their help.

Besides that, soldiers are usually ready to follow anywhere a leader who is perfectly fearless himself, and so, in a few months, Bonaparte had driven the Austrians out of Italy. He crossed the Alps which divide Italy from Austria, and was marching upon Vienna, the Austrian capital, when the Austrians offered to make terms with the victor.

Bonaparte had not been inclined to do whatever the Directory in Paris told him; they began to be nervous about what he might do next. So they were very well pleased when he proposed to conduct an army to Egypt and take possession of it in order to strike at the British in India. They thought it would be just as well to keep such a popular and brilliant and self-willed soldier out of the way. But Bonaparte meant to conquer Egypt and Western Asia, and then, with a mighty army at his back, to turn and make himself master of all Europe.



NAPOLEON WHEN A BOY
From a sketch by M. Girodet, by permission of Messrs. McClure.

Now let us look at the man who was going to spoil that plan of Bonaparte's, and who, before he died, was going also to make England safe against all the great Corsican's schemes. For we must know that Bonaparte saw there was no power in the world which stood in the way of his ambitions so much as the British, and he was bent, above everything, on ruining that power.

Nearly eleven years before the birth of Bonaparte, Horatio Nelson was born in a country vicarage called Burnham Thorpe. He was a delicate little boy, but just as plucky and fearless as could be, and he was quite determined to go to sea; so he was allowed to do so, though everybody thought the life would be so hard that it would be sure to kill him. But he was not the kind of boy to get killed in that way.

On one of his first voyages he went to the Arctic regions, and what must he do but go out with another midshipman to try and kill a Polar bear. It was lucky that some more of his shipmates came along, for young Nelson had found his bear, and they saw the bear, which he had wounded but not killed, making for Nelson, and Nelson making for the bear with the muzzle of his musket instead of running away. A good shot from one of their guns finished the bear, or there would have been no battle of the Nile and no Trafalgar. But the story shows the boy's mettle. Now, when France and Great Britain were at war, the thing that mattered most to the latter, as it was an island, was that its navy should be stronger than any other, so that it could send its ships wherever it chose and keep its enemies from crossing the seas. The first famous thing that Nelson did was achieved at the time when Bonaparte had been so successful in Italy. The Spaniards had allied themselves with the French, and their fleet and the French fleet together were bigger than the British. It was very important to win a victory over them which might give England the command of the sea.

When Admiral Jervis found a chance of attacking and destroying one part of a big French fleet before the rest could come to help it, he took that chance and won the great victory of Cape St. Vincent. Yet he might not have won it if Commodore Nelson had not seen that

NELSON IN TRIUMPH AND IN DEATH

Few naval victories have been so complete as Nelson's triumph over the French at the battle of the Nile. With fewer vessels than the enemy, he crept down the French line and annihilated almost their whole fleet. When he returned, he landed at Yarmouth, as shown in this picture by Frederick Roe, and was received with wild enthusiasm. Bonfires were lighted, and his journey to London was a great triumphal progress.

Great as was the victory of the Nile, the supreme triumph in England's naval history was the battle of Trafalgar, which thus gave to Britain, for more than a century, the mastery of the seas. But the joy of the nation was turned to mourning in the hour of victory by the death of its hero, and here we see the last moments of Nelson in the cockpit of his flagship, the Victory, after he had heard of the crushing and decisive defeat of the French fleet.

he could do more good by checking the rest of the French fleet than by joining in the other part of the battle. And although Admiral Jervis had given different orders, he was very much pleased with Nelson for acting as he did; so, very soon after, Nelson was raised to be a rear-admiral.

Now, the time had come when Bonaparte wanted to sail to Egypt with his great army, and Nelson was lying in wait to prevent him sailing from Toulon. But Nelson had to put into port to repair his flagship, and Bonaparte put to sea. Nelson's ships were soon pursuing him, but passed him by in a fog without knowing it, and so went hunting after him in another direction. Thus Bonaparte got to Egypt, and landed his army and conquered the country, as we read on page 2274. But while he was there Nelson found the best part of the French navy at anchor in Aboukir Bay; and, having the wind behind him, he sailed with his smaller fleet half-way down the French line, with half his ships on one side of them, and half on the other, so that he got them between two fires; and all that evening and half the night the battle raged, and in the morning all but two of the French ships had either been taken or sunk. That was the great battle of the Nile, for which Nelson was made a peer. After that it was not easy for French ships to appear in the Mediterranean Sea at all, and Bonaparte, in Egypt, could get no more men or money or stores from France, so that he could not set about the great conquests of which he had dreamed, or bring his army back to Europe. Still, after a time he managed to find a ship which took him back to France with a very few of his friends; and then he got himself made First Consul, which really meant that he was the absolute ruler of France. He succeeded in doing that because the soldiers were on his side, for the Parliament, or Assembly, did not at all like to give up its power.

NELSON AS A MIDSHIPMAN

Things had not been going well with the French while Bonaparte was in Egypt. The Austrians were back in Italy, and he had to hurry off, taking an army, by a wonderful and very difficult march, over a great pass in the Alps, so as to appear when the Austrians did not expect him. He beat them again in Italy, and another general, Moreau, won the great battle of Hohenlinden.

After that the Austrians sought peace once more. But before there was real peace Nelson had to be at work again; for Bonaparte wanted to get the Danes to let France use their fleet against England. So Nelson was sent to the Baltic to get the Danish fleet handed over to him instead. There was another admiral, named Parker, over him, but it was Nelson who had to fight the battle of the Baltic, which made the Danes submit. The victory put an end to that plan of Bonaparte's, and after the Danes were defeated there was peace even with Great Britain for a little while.

Bonaparte took to signing his Christian name instead of his surname, as kings do, before he made himself the Emperor of the French. We must remember that he was not only one of the very greatest soldiers that ever lived, but was also a great ruler, and he did many good things for France during the time of peace. He could not be content while England still ruled the seas and would not do his bidding; so it was not long before war was declared again. England could not send great armies to match his on land, and he could not send fleets to match hers on sea.

He made a plan for a great invasion, but there was no way of bringing his soldiers over so long as the fleet was on guard. This was how Nelson won his last and greatest victory. The French admiral, Villeneuve, played a sort of hide-and-seek with him, sailing off to the West Indies, and then doubling back in the hope that he would manage to join forces with another French fleet, and so be able to

NAPOLEON AND WELLINGTON ON THE FIELD

The battle of Arcola was one of the most brilliant of Napoleon's victories. With three Austrian armies approaching him, he made a daring night march, and attacked the Austrians on swampy ground where cavalry could not charge. After three days' fighting, the French were victorious. During the battle Napoleon nearly lost his life. Seizing a flag, he rushed on the bridge to rally his men, as shown here, and was pushed into the river.

After the defeat of Napoleon's army at Waterloo was assured, and the Prussians were in hot pursuit of the French, turning their retreat into a rout, the Duke of Wellington and the Prussian general, Blucher, met on the battlefield, and, grasping hands, congratulated one another upon the great victory that had been won, as shown in this picture by Daniel Maclise. The brunt of the battle had been borne by the British, who were tired out, and Blucher's arrival put an end to any hope that Napoleon might have had of rallying his shattered forces.

command the Channel long enough for Napoleon to get his invading army across. But he did not succeed in joining the other fleet.

Then Napoleon saw there was no hope of invading England, and carried off his army from Boulogne to win the great battle of Austerlitz. But Nelson went after Villeneuve, and found him with a great fleet, part French and part Spanish, at Trafalgar. His ships sailed down on the French line, and pierced it in two places, and treated it very much as the other fleet had been treated at the battle of the Nile.

This was the day on which Nelson ran up his famous signal, "England expects every man to do his duty," and set a glorious example which was gloriously followed. But before the victory was complete, which ended all hope of France resisting England on the seas, the hero himself had fallen, pierced by a bullet. He lived just long enough to know that his great task was successfully accomplished. So died one of the greatest sailors in history.

How Napoleon tried to ruin England and become master of the world

Now, Napoleon knew that it was not by fighting battles that he would ever have the chance of humbling England, but he thought he could ruin her by preventing her from either selling or buying anything in Europe; and that was one reason why he wanted all Europe to bow to his will, besides the wish to make himself the mightiest emperor the world had ever seen. He set up his own brothers to be kings in Holland and in Italy and in part of Germany—kings who would really be his subjects; and at last he set up one of them, named Joseph, to be King of Spain.

This, in part, was his undoing; for the Spanish people would not have a Bonaparte for their king, and rose up against him. The British sent an army to help them, and at their head was the great soldier who finally broke Napoleon's power in the last great fight of Waterloo. The strange thing is that Napoleon did not go himself to Spain to crush Wellington, but left the work to his marshals, whom Wellington out-generalled. But he himself thought it more necessary to make Russia obey him, when she was the only remaining country in Europe which did not fear him. That is why he went on that terrible expedition to Moscow, whence the lack of food and shelter forced him to retreat through the bitter winter weather, so that only a shattered remnant of his army ever returned home.

The Iron Duke, who broke the power of Bonaparte

The Duke of Wellington was only Sir Arthur Wellesley when he went to command the British army which was to help the Portuguese and Spaniards. He was born in the same year as Napoleon, and was exactly forty years old when he took up the Spanish command. He was a younger brother of an Irish peer, Lord Mornington, who was sent out to be Governor-General of India, and who afterwards became the Marquess Wellesley.

Sir Arthur Wellesley went to India, too, and fought in the great wars there, first against Tippu Sahib of Mysore, and afterwards in command of the British troops and sepoys against the Marattas, when he won the famous battle of Assaye. Napoleon spoke of him with contempt as a "sepoy general," but he and his marshals were to learn that they could not afford to despise "sepoy generals."

In after years men called him the Iron Duke. Let us look at his fine, firm face, with the great nose and the strong mouth: a man who could never be shaken out of his stern self-control. Long years after, men must have been moved as they saw the Iron Duke, now white-headed, break down and shed tears in addressing the House of Lords on the death of his noble friend, Sir Robert Peel. Hard and cold he seemed, but altogether just, and with never a hint of self-seeking.

How Wellington beat back army after army in many famous fights

It was no easy task that he had in what is called the Peninsular War, when Napoleon's most skilled marshals came to fight him, one after another—Victor, and Masséna, and Marmont, and Jourdan, and Soult; when he could trust nothing to the Spanish soldiery, but had to depend for all real work on his British regiments; when one defeat would almost certainly have led to his recall.

Year by year he fought his campaigns, and beat off army after army

FIGHTING THEIR BATTLES OVER AGAIN

The battle of Waterloo will always be known as one of the turning-points in the world's history. Here the power of Napoleon, the man who had changed the map of Europe, was for ever broken. And whenever Waterloo is spoken of, Wellington, the victor of Waterloo, will also be remembered. In this picture we see the Iron Duke, as Wellington came to be called, years after the battle, surveying the field of his great victory that saved Europe.

With what different feelings from those of Wellington must Napoleon, after his exile to St. Helena, have recalled the mighty battle that sent him to his doom! Away in his rocky island home, guarded beyond the possibility of escape, he must often have sat on the lonely crag, as shown here, fighting the battle over again, correcting the blunders that led to his defeat, and wishing that the past was not beyond recall.

in his famous fights at Talavera, Albuera, Fuentes d'Onoro, and Salamanca, until at last he sent King Joseph Bonaparte flying from Spain after the rout of Vittoria, and fought his way into the south of France, just when all the armies of Europe were closing in upon Napoleon, whose power had been all but destroyed in the fierce three days' battle of Leipzig, which men called the Battle of the Nations.

THE MIGHTY EMPEROR WHO BECAME THE KING OF A LITTLE ISLAND

The great conqueror had been conquered. He had cast aside his wife, Joséphine, that he might wed an Austrian princess; then he had suffered the awful disaster of Moscow; once more he had hurled himself against the combined Powers of Europe, and, in spite of a victory at Dresden, had been overwhelmed by their numbers at Leipzig. The lion was meshed in the toils; but the Powers of Europe suffered him to abdicate his imperial throne, and retire to the little island of Elba, in the Mediterranean.

A twelvemonth had not passed before the world was startled by his reappearance in France. His old soldiers flocked to his standard; they were sent forth to crush him, but instead they joined his army—and the only nations that were at all ready to face him were the British and the Prussians. Both of these peoples were able quickly to place armies in Belgium or on its border, Wellington commanding the one, and stout old Blücher, whom folk called "Marshal Forwards," the other. If Napoleon could only crush them before Russia and Austria could take the field against him, he might once again be master of Europe.

HOW NAPOLEON FELL FOR EVER AND WAS BANISHED TO A LONELY ROCK

Napoleon tried his hardest to overthrow the armies of Britain and Germany, and he very nearly succeeded. He struck at a point just between Wellington and Blücher, and beat the Prussians in a battle at Ligny, while the British stood at bay at Quatre Bras. Now, the question was whether he could keep Blücher and Wellington apart till he had beaten Wellington. The "Sepoy General" took up his stand at Waterloo, and all day, throughout Sunday, June 18, Napoleon drove the masses of his troops up the slopes against the British lines, and all day the British drove them back, time after time.

At last, as Blücher and his Prussians began to arrive on the field, the French made their last desperate charge, and met their last desperate repulse. The British line swept forward, and the Prussians came thundering on their flank; the defeat became a rout, a wild flight: the army of Napoleon was shattered for ever.

When the fallen emperor yielded himself, none dared treat him generously; all feared him and distrusted him too much. He who had shaken the world with the stamp of his foot, dazzled it with the flash of his sword, was banished to end his days on the lonely rock of St. Helena, far out in the mid-Atlantic Ocean. And in France the brother of the murdered monarch, Louis XVI., was restored to rule as king.

THE IRON DUKE, WHO SAVED FRANCE FROM THE VENGEANCE OF HER FOES

In those days the Iron Duke showed himself a wise and shrewd man, checking those who would have taken a fierce revenge on France for all the troubles Napoleon had wrought. But later he showed that even a wise man may have little understanding of the governing of a country like England, where people desire to have a voice in their own ruling.

Yet, for all that, he knew that there are times when the wise general will beat a retreat; and so, when the Tory party in Parliament came to look upon him as their chief, his most notable acts were just when he told them that they would do more harm than good by resisting changes on which he saw that the people were fully determined.

Waterloo had been fought and won nearly forty years before the great duke passed away, full of years and honours, loved by the nation in his old age, as it had never loved him when all Europe was ready to do homage to the conqueror of Napoleon.

And so let us leave him to his rest in St. Paul's Cathedral, where they laid him—the saviour of Europe—"to the noise of the mourning of a mighty nation," and where there is a splendid monument erected to his memory.

The next Men and Women begin on 4617.

This picture shows a machine worked by the sun. Hundreds of mirrors are mounted in what looks like a gigantic lamp-shade turned upside down, and the sun's heat-rays are collected by the mirrors and reflected on to a large glass tube with a boiler at the end, where the heat turns water into steam.

HOW HEAT WORKS FOR US

CONTINUED FROM 4324

We know that when things are hot they have power in them which can be used. The most famous case of this—which, according to the story at any rate, set a great man, James Watt, thinking—is the case of the lid of the kettle of boiling water. The heat that is put into the water has the power of making the lid move. Now, if heat applied in the form of steam can make the lid of a kettle move, why should it not start motion in something that is attached to a wheel? The answer to this question is supplied by every engine that is driven by heat all the world over to-day.

On the other hand, just as heat can do work, so work can make heat. One of the old ways of lighting a fire was to rub together two pieces of dry stick, and that produced heat enough to make a spark. In the same way, anyone can prove that heat can be produced by work if he rubs his hand on his coat.

The work of rubbing or striking a match puts heat in it, and when it is hot enough it catches fire. In a word, the kind of motion which we call heat can be turned into ordinary kinds of motion, like that of a wheel or the lid of a kettle; and ordinary mechanical motion, as it is often called, can be turned into the special motion called heat. It is worth while to know the simple way in which this may be stated in scientific language. The Latin word for a mass is *moles*, and from that we get the word *molecule*, which means a little mass. Now, when a thing which we can see—such as a match, or our hand, or a wheel—is in motion, we may call that a case of *molar motion*—the motion of a mass. But heat, which is a case of the motion of the molecules of things, may be called *molecular motion*. So we may say that molar motion may be turned into molecular motion, or molecular motion into molar motion; in other words, work may be turned into heat, or heat may be turned into work.

The importance of understanding this rightly in our thinking is very great indeed. Heat and work sound such very different things. It is true that we can get work out of heat, and heat out of work. There does not appear to be any particular reason why there should be any fixed relation between the amount of heat to be got from a particular amount of work, or the amount of work to be got from a particular amount of heat. It sounds as if work and heat were two such different things that they could not well be measured against each other.

But if we think of heat as molecular motion, and of work as molar motion, then it seems reasonable that one kind of motion should be turned into the other, and also that there must be an absolutely fixed amount of either kind of motion that can possibly be got from the other kind. If that be not so, some motion is being got out of nothing, or some motion is being made into nothing; and we are sure that neither of those things can happen.

What we have just been saying makes the basis of a very great and important science called *thermo-dynamics*. We might translate that "heat-force"; and this great science deals with all the relations that exist between heat, on the one hand, and power, on the other hand. This science bears not only upon the making and working of all machines made by men, but it bears upon the history and the future of the living and eternal machine which we call the universe, and which is made from everlasting to everlasting by God.

A LAW OF SCIENCE THAT WAS PROVED AFTER TWO THOUSAND YEARS

The great law of the conservation of energy has been established in modern times by the study of heat and work. Before the birth of Christ, great thinkers guessed that what we now call the law of the conservation of energy must be true; but the proof of its truth had to wait until the nineteenth century after Christ, and depends upon whether the amount of work we can get from a certain amount of heat, or the amount of heat we can get from a certain amount of work, is absolutely fixed.

Later still, we have begun to see why this must be as it is, because we see that, after all, what seemed to be such a mystery is only a case of changing one kind of motion into another kind of motion, and that is the thing we see and do for ourselves every day.

Rather more than sixty years ago, a celebrated Englishman, named Joule, proved, by experiment, that there is a certain amount of work which can be got out of a certain amount of heat; and nowadays we use "J," the first letter of his name, to mean the amount of work which can be got out of a certain known or measured amount of heat.

Thus, we take the amount of heat which can raise the temperature of one pound of water at 60 degrees Fahrenheit up to 61 degrees Fahrenheit, and we find that that amount of heat is equal in power to raising 778 pounds through a height of one foot, or one pound through a height of 778 feet. But what the exact figure is matters nothing at all, compared with the great and all-important fact that there is this relation.

HOW HEAT CAN BE CHANGED INTO WORK, AND WORK INTO HEAT

The first law of this part of science is, therefore, that between heat and work there is a constant relation; that either can be transformed into the other. But there follows a second great law which says that, though the first law is true, yet heat will only travel from a body that is higher in temperature to one that is lower.

The first law is another form of putting the law of the conservation of energy, but the second law says that, though energy is never lost, yet there are only certain conditions under which we can use it so as to get work done. The energy may be there, but it may not be available, and that is true of all heat wherever it is found, except where it can flow to something that is less hot. For practical use for doing work, it is not sufficient that energy be not lost; we must be able to get at it.

Every machine that is run gets warm, and that warmth is given away to the air around it. Our bodies, which are living machines, though they are also more, are always losing heat to their surroundings, and, indeed, it is a general rule that other forms of energy, such as the chemical energy in our food, or the chemical energy in the food or fuel of an engine, tend to be turned into heat, and the point is that this heat gets scattered and cannot be used again.

THE MACHINE THAT GIVES HEAT WHEN WE WANT IT TO GIVE WORK

First, let us see how this affects the engineer. It means that when he makes and uses a machine from which he wants to get work, only part of the energy which he puts in comes out as work, and much of it comes out as heat. This heat is not only useless, as a rule, but worse than useless, and causes endless trouble in order that it shall not make the engine so hot that it will not work. Also, the

question of cost comes in, because all the fuel has to be paid for, but only a small portion of the power in the fuel is turned into the work which we want to get out of it.

The world, as we know, is at present living upon its supply of coal, and doing so at a tremendous rate, but far less than one-tenth part of the energy contained in that coal, and put there, so to speak, by the sun, is really used by mankind. The rest is frittered away into the air as heat, and simply wasted.

THE GREAT WASTE OF ENERGY THAT GOES ON IN THE WORLD

An ordinary fire is, perhaps, the most wasteful of all ways of transforming energy, but, at any rate, the heat produced is of some use for the time. Now, if we look at any of the engines which are at work all over the earth, we find that they can all be studied from this point of view. How much of the energy put into them comes out as work, and how much is wasted as heat? We are not far wrong if we say that one-tenth of the energy put in is used, and nine-tenths are wasted.

Anyone who could invent a machine that would turn into work all the energy put into it, or half, or one-third, or one-quarter, would soon be the richest man in the world. So important is this question that there are, of course, everywhere men working at it. The word they use is "efficiency," and their business is to try to increase, even perhaps by only one per cent., or less, the efficiency of the engines they are working at—that is to say, the proportion of work they do compared with the amount of heat they produce which is useless.

THE SECRET OF POWER IN OUR MUSCLES WHICH NO MAN CAN DISCOVER

The most efficient engine in the world is a living muscle, but the secret of its efficiency has yet to be discovered. Even a muscle, however, does not turn into work all, or even half, of the energy supplied to it; the rest is turned into heat, though this heat has to be looked at very differently from the heat produced, say, in the engine of a motor-car, for it keeps our bodies warm, and maintains them at the temperature at which we can best live. Both on the score, then, of its pure efficiency in terms of work, and its usefulness in regard to the heat produced, a muscle is vastly superior to any machine ever made, and that is to say nothing of its powers of lasting and repairing itself.

But this question of the production of heat by machines, though it is of deep practical importance to mankind, is of vastly greater importance in another way. It is not only machines that tend to turn useful energy into heat that cannot be used *again*—even if it is useful at the time—in the sense that the mill-wheel cannot run with the water that has passed. All the changes of energy that we can discover seem to follow the same course.

Nearly all chemical changes produce heat, and that heat is scattered and lost. Every kind of motion, besides the motion of machines, is in some degree turned into heat by friction, and that heat is scattered and lost. And so we have to learn a new idea which goes along with the great truth of the conservation of energy, and must always be remembered together with it—this is, that though no energy is ever lost to the world, so to speak, it may very easily be lost to us.

THE HEAT FLOWING FROM THE SUN AND FOR EVER PRODUCING WORK

We may classify all sorts of energy, indeed, according to their usefulness for us, and then we discover that it is the general tendency for energy to be *degraded*—to fall in the course of its changes from a more useful to a less useful class. The general end of these changes tends to be that the energy is degraded to the lowest class of all—that of scattered heat, which we cannot use at all. An instance of energy in the highest class is furnished by the energy of the sun—a body which is intensely hotter than its surroundings. The flow of heat of this hot body to less hot bodies produces work, just as the downward flow of water from a height may do work.

We have only to consider for a moment what happens to the sun's radiations to see that, in the course of every change which the power of them undergoes in our bodies or elsewhere, a certain amount is frittered away as heat, and so this energy of the highest class is rapidly degraded to the lowest. We do not suffer, and we are not alarmed, and the reason is that there is always a fresh supply of energy coming from the sun. But that supply, though

it will last a very long time, cannot be endless. Now that we know what *the degradation of energy* means, we must learn the use of another word, first employed by Lord Kelvin some half a century ago. He spoke of what has ever since been known as *the dissipation of energy*. When we speak of a foolish man who dissipates his fortune, we mean that all his money is spent and scattered, and that is what is meant by the dissipation of energy.

WHY WE CAN NEVER GET A REALLY PERFECT MACHINE

Now, we read on page 3840 about the results which would have to follow if the law of gravitation were unopposed, so that by its action the whole of the matter in the universe would all be gathered together into one mighty heap. Just in the same way, the argument now is that all the energy in the universe tends to be steadily degraded and dissipated, taking the form of scattered heat, incapable of doing anything.

If we had a perfect machine we should be able to work it backwards as well as forwards, turning heat into work and work into heat, and never losing anything. There is no such machine, and, according to Lord Kelvin, not even the universe itself is a perfect machine in this sense of the word.

That is to say, it has a bias towards working in one direction, which is the direction of the dissipation and degradation of energy. If this goes on, as it appears to do, the consequences must be tremendous, and we find ourselves led to the same kind of result as we supposed when we imagined that gravitation had nothing to oppose it.

THE RUNNING DOWN OF THE CLOCK OF THE UNIVERSE

If the idea of the dissipation of energy is really true, and the whole truth, it means that the universe must be travelling towards a state of things in which nothing happens—a state which we might describe as the death of the universe. Its matter and energy would still be there, but they would have lost their power of doing anything. Nothing would happen, there would be no life and no motion of any kind. This idea makes us think of the universe as a great clock, made, wound up, and set going. It may run for a very long time, but, like other clocks, it must run down at last. Here we are faced again with the idea of a beginning and an end to the history of the universe. Thus, if we take our solar system as a case in point, we see that, at present, just because the heat-level is higher in the sun than in the planets, heat flows from the sun to the planets, and so on our earth life is possible.

But the spreading out and levelling of the heat in the solar system must some day come to an end, and with it must come to an end not only life, but all the other processes in the solar system which depend upon this difference of heat-level.

The prospect of the theory of the dissipation of energy is that the solar system and the whole universe must, at last, reach a stage in which all the other forms of energy have been degraded and dissipated into heat, and that heat will be spread equally through all the matter of the universe. That would be the end of its history.

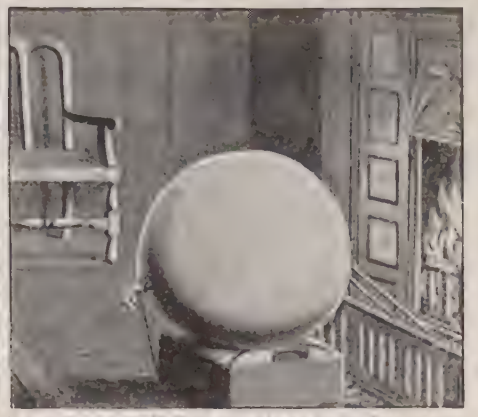
THE WINDING UP OF THE CLOCK OF THE UNIVERSE

We may slightly change the words of a great student who summed up the case, as it was then thought, at the end of the nineteenth century, and who spoke as follows of the doctrine of the dissipation of energy: This remarkable property of all natural processes seems to lead us to the idea of a definite beginning and to shadow forth a possible end—the interval, which contains the life or history of Nature, being occupied with the slow but inevitable running down or degradation of the great store of energy, from an active to an inactive or unavailable condition.

But, as we study this subject now, towards the end of the first decade of the twentieth century, we are beginning to see farther and deeper than all but one of the wisest saw in the nineteenth century.

Herbert Spencer stood alone among the great thinkers of the nineteenth century in declining to accept the doctrine of the dissipation of energy. He saw too deeply into the nature of things to believe in the old ideas of beginning and ending, and he saw that the argument for the dissipation of energy was not complete. He declared

HOW HEAT MAKES THINGS EXPAND



In these two pictures we see how heat affects a gas. If a balloon be half filled with air, as in the first picture, and placed in front of a fire, the air, as it gets hot, expands and fills the balloon, which will at last burst.

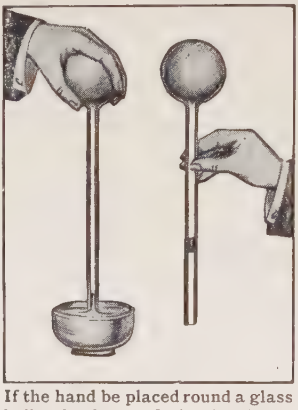
This picture illustrates the effect of heat upon solid bodies. When a railway line is laid down, space is always left between the rails, as indicated by the arrows in the picture, to allow for their expansion through heat.

If we place a liquid, like methylated spirit, in a narrow-necked bottle and stand it in ice, the liquid will shrink from the point x, at which it stood, to y. Now if the bottle be placed in hot water, the liquid will rise in the neck to x.

that there must be other processes going on, none the less real, though not so easy to see, which were, so to speak, winding up the clock while other processes, which we could see, were tending to run it down.

Steadily, during the last ten years, the idea of this dissipation of energy, as *completely* true, has been losing credit among those who study these matters, and the deep insight and marvellous wisdom of Herbert Spencer are beginning to be justified in this respect, as in many another, by the discovery of processes and possibilities in the universe which lead us to believe that it is, indeed, a perfect, an eternal machine, besides being very much more.

The more deeply we study, the more convinced we are that the real answer to this question is the same as the answer lately discovered to the question about the results of gravitation. There we find that what seems to be a process all in one direction, which must have a beginning and an end, is only half the truth; and when we learn the other half, as, for instance, in the study of what we call radiation pressure, we see reason to believe that the universe can go on and on for ever.



If the hand be placed round a glass bulb, the heat of the hand will expand the air in the bulb; but when the hand is slightly removed, the air cools and shrinks a little, so that some water is forced up the tube. If the hand be quite withdrawn and the tube taken from the bowl, the air in the bulb cools and shrinks, and the water in the tube is forced up by the outside air.

Just in the same way we are beginning to discover the processes which act in the other direction, and which will lead us to the belief which we have already stated, the belief of the wisest of all ages, that the universe is from everlasting to everlasting.

We have now learnt enough to show us how extremely important is the question of temperature, and by temperature we understand heat-level. It is difference of temperature that gives heat the power of doing work. That difference of temperature means that the heat will flow, and in flowing can be made to do things. Now, what exactly is difference of temperature? Indeed, what is temperature at all? Our first inclination will be to answer that the temperature of a thing is the amount of heat in it, but we shall find that that is not true. It is true that if we take a given amount of a given thing, and add heat to it, it will get hotter; its temperature will rise, and that rise of temperature means in that case that there is more heat in the thing.

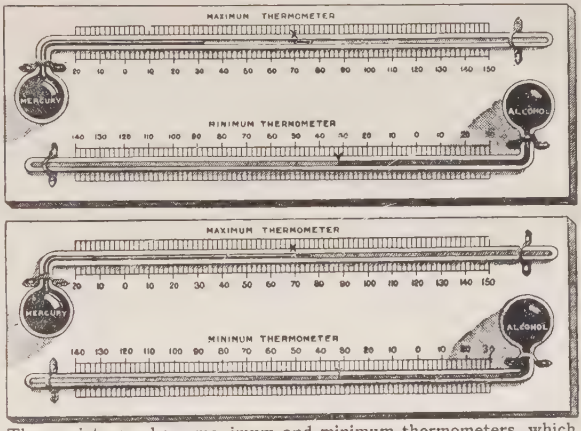
But even if we take a given thing, such as water, we find that to raise a given quantity of it one degree in temperature, at some level in the temperature scale, requires rather more heat or rather less heat than to raise its temperature one degree when it is much colder or much hotter to start with than it was in the first case. Then, again, there is much more heat in a lot of cool water than there is in a very little water that is hotter, so that again we cannot say that temperature is the amount of heat in a thing. We must think of temperature as if it were like the level of water. Even a little water at a great height, falling into a large lake, has a something about it which the lake has not. For instance, it will turn a wheel. Now, temperature is like the level of water, and has no more to do with the amount of heat, as such, than the mere bulk of water has to do with its power. There is something in the slender waterfall that there is not in the lake below, and that something corresponds to the height from which it falls, and enables it to do work. So the temperature of a thing may be compared to the height from which the water falls in the other case; and, other things being equal, the higher the temperature, the greater is the work that the thing can be made to do as it cools.

The word *thermometer* really means heat-measurer, but we are now ready to learn that, though the thermometer is called a heat-measurer, it is not a heat-measurer, but a measurer of heat-level. Think of the water falling into the lake, and we see the difference. The thermometer corresponds to an instrument that should tell us what height the water fell from, but that told us nothing about

the amount of water that fell. The thermometer tells us nothing about the amount of heat, but only about heat-level.

The first thermometer was made by Galileo, rather more than three hundred years ago. It was an air thermometer—a glass tube ending in a bulb. This tube was heated and then turned upside down in a vessel of water, as shown in the picture on page 4369. As the air inside the bulb, which had been heated, began to cool, the water would run up the tube.

The air inside the bulb would occupy more space if it were hot, and less if it were cold, and the water would run up the tube in more or less degree accordingly. So by the height of the water something could be told as to the temperature of the air. Now, directly we consider this we shall see, from what we have already learnt, that this instrument was a barometer as well as a thermometer, for the water would partly be pushed up by the air.



These pictures show maximum and minimum thermometers, which register highest and lowest temperatures. In the upper picture the minimum thermometer is at 32 degrees, the lowest point reached overnight. The alcohol carried the indicator, V, to this point, and left it there when the temperature rose, as in the lower picture. In the maximum thermometer of the lower picture, the mercury is at the supposed highest temperature of a day. It has pushed the indicator, X, to 70 degrees, and when it shrinks to a lower temperature, as in the upper picture, the indicator is left at 70. The indicators mark the highest and lowest temperatures reached.

In this, its first form, the instrument was not, therefore, very useful, for no one could tell to what extent it was measuring the pressure and to what extent it was measuring the temperature of the air. What was required was to close the tube altogether after heating it, so that the atmospheric pressure should have no effect upon what happened inside it. This was not done until half a century after Galileo's first work. At this time, instead of water, alcohol was used. In 1670 mercury was first used.

If we wish to make an ordinary thermometer, then, we take a fine tube with a bulb at one end, and fill the bulb and part of the tube with mercury. Then we boil the mercury. This means that part of it forms a vapour, which travels up the tube and pushes away the air in front of it. While this is going on, we close the end of the tube, and allow the mercury to cool. A practically empty space is then left above the level of the mercury in the tube, and if the mercury has any reason to expand or to contract, it will be able to do so freely in either direction.

The hotter mercury is, the more it swells, and the more space it takes up; the colder it is, the smaller the space taken up. Therefore, the level of the mercury in the tube tells us how hot it is. The higher it is, the hotter it is; and the lower it is, the colder it is. We shall notice that this is just the opposite of Galileo's air thermometer, for in that the colder the air inside, the higher stood the column of water. The really difficult and important part of making a thermometer is yet to come, because we have to find what height in the mercury of the tube corresponds to a certain temperature. It would be no use having a thermometer that was wrongly marked, especially if it is wanted to measure differences in temperature that are very small.

Notably does this apply to the thermometers used by doctors in order to find out how hot the blood of their patients is, for in such a case the differences in temperature are quite small, but may have very large meanings when the doctors are led astray. Nowadays, therefore, great skill and trouble are employed in testing all except the very cheapest thermometers.

The next part of this is on page 4473.

THE PRINCESS WELCOMES HER DELIVERER

The young prince rode straight up to the gates, which were flung open to receive him. There at the foot of the steps stood the beautiful princess in her bridal robes, with a smile of welcome in her eyes

THE WATER OF LIFE

CONTINUED FROM 4278

ONCE upon a time there lived a king who had three sons. One day the king fell ill, so ill, indeed, that the court physician despaired of his life.

As the three young men were walking in the garden, they met a little old man, who inquired what made them so sad.

"Our father, the king, is dying," they replied, "and nothing can save him."

"The Water of Life could save him," said the old man, "if you are brave enough to face the dangers that beset the path of those who seek it."

"I will go in search of that water," said the elder brother, "even though it should cost me my life." And the next day he set off.

Before he had gone very far he found himself in a deep valley, and on a bank by the roadside stood an ugly dwarf in a sugar-loaf hat and scarlet cloak.

"Whither away?" asked the dwarf.

"What is that to you, imp?" retorted the prince rudely. Whereupon the dwarf gave a loud laugh, and disappeared. So enraged was he at such treatment that he caused a spell to be cast over the valley, so that the prince, as he rode forward, found the mountains slowly closing round him, until he could not go a step forward, nor could he retrace a single step.

At the palace the two younger brothers were anxiously awaiting the prince's return, fearing some ill, when the sick king became rapidly worse.

"I will tarry no longer," said the second brother. "At sunrise I, too, will go in search of this wonderful water."

The young man was brave, and all went well until he came to the valley.

"Whither away?" asked the dwarf.

"Out of my path, busybody!" replied the young man. "I am in haste, and you will hinder me."

"That I will," replied the dwarf; and he cast the same enchantment upon him.

When neither of the brothers returned, the youngest prince of all determined to start. So at daybreak he set out on his white horse, and so rode on till he came to where the dwarf stood.

"Whither away?" asked the dwarf.

"I go in search of the Water of Life," replied the youth. "My father is dangerously ill, and if you can guide me to the place where this magic water lies, I shall indeed be grateful."

"Well spoken!" cried the dwarf. "The Water of Life springs from a well in an enchanted castle. With this rod and these two loaves you may go in safety. When you reach the door, strike it three times with this rod, and it will fly open. Within are two lions, waiting for prey. But have no fear; throw them this magic bread, and they will not molest you. Hasten to the well, and take some of the water, but see that you do not linger, for at twelve the door shuts, and you will be lost."

Thanking him for his friendly aid, the prince hurried on until he came to the enchanted castle, where he found everything just as the dwarf had said. With the aid of the rod and the loaves, he found no difficulty in getting into the castle. In a great hall, the remains of a banquet lay on a table, and the prince picked up a loaf and slipped it into his pocket, and he took a sword from one of the knights and stuck it into his belt.

At the end of the room, partly hidden by a silken curtain, lay the most beautiful girl the young man had ever seen. As he approached, she sat up.

"At last you have come, my prince!" she cried. "For a hundred years I have been awaiting you. Marry me, and the enchantment which is on this castle will vanish."

The prince was only too willing to have such a lovely bride, but he begged her to direct him to the magic well, promising to return in a year. The princess told him, and the prince filled the cup with the precious water, and was soon on his journey home.

In due course he came upon the dwarf, to whom he related his adventures.

"You have done well," said the dwarf. "With that sword you can slay whole armies, and that loaf will never grow smaller, however much of it you eat."

But the prince had not forgotten his brothers, and he asked the dwarf if he could tell him where they were.

"They were proud and ill-behaved," answered the dwarf; "and so I laid a spell on them for punishment."

The prince begged so hard that the dwarf set them free, and the three brothers set out for their father's palace.

One night, while the young prince slept, his brothers began to plot how they might steal the Water of Life. "For," said they, "our father will be so pleased with our brother that he will leave him the kingdom that should come to us." So they stole the magic water and refilled the cup with sea-water.

When they reached the palace, the young man hastened to his father's bedside, and gave him the cup. But the sea-water made the king worse than he had been before. Then the elder brothers came forward with the real Water of Life; the king drank of it, and was instantly cured. A grand feast was given in honour of the two brothers, but the people were so furious with the youngest son that they succeeded in persuading the king to consent to his being put to death. But soon after the old man began to blame himself bitterly for allowing his favourite son to be killed.

"My son! My son!" he cried. "How could I have been so cruel?"

At these words one of his servants fell down on his knees before him, and confessed that he had not had the heart to put him to death, but had hidden him in a wood.

The king gave orders for his son to be brought to him without delay. But when they reached the wood the young prince could not be found.

A full year had now elapsed since the finding of the enchanted castle, and the eldest brother determined to win the lovely princess and her kingdom. The second prince had the same thought, but he said nothing to his brother.

Now, the princess was determined that none but the rightful prince should share her kingdom, and so she gave instructions for a road of pure gold to be made, leading to the castle gates.

"My prince will ride up that shining path, turning neither to right nor left," she said to her courtiers. "When he arrives, admit him; but open to no other."

When the eldest brother saw the golden road, he thought it a pity to spoil anything so beautiful, so he turned his horse and rode along by the side of it. But when he arrived at the gates the courtiers refused to admit him.

By and by the second brother rode up. "What a beautiful road!" he thought. And he, too, rode by the side and was refused admittance.

At last the youngest prince, seated on a beautiful white horse, approached the castle. So anxious was he to see his lovely princess again that he never even glanced at the golden road, but rode straight up to the gates, which were flung open to receive him.

There, at the foot of the steps, stood the princess in bridal robes, with a smile of welcome in her eyes. The marriage ceremony took place without delay, and the prince carried his lovely bride back to his father's palace, where they were received with great joy.

The elder brothers were banished, and when the old king died, the young prince and his bride reigned together.

MERRYMIND, THE LITTLE FIDDLER

A TALE TOLD BY GRANNY'S WONDERFUL CHAIR

ONCE upon a time there lived a certain poor man and his wife, who had thirteen children. Twelve of these children were called by names common in the north country—Hardhead, Stiffneck, Tightfingers, and the like; but when the thirteenth came to be named, either the poor man and his wife could remember no other name, or something in the child's look made them think it proper, for they called him Merrymind.

When the youngest was old enough to look after his father's sheep, there happened the great fair, to which everybody in the country went.

Merchants and dealers of all sorts crowded to that fair from far and near. The poor man who owned the large family could afford them little to spend; but, as the fair was held only once in seven years, he opened the leathern bag in which his savings were stored, and gave every one of the thirteen children a silver penny.

The boys and girls had never before owned so much pocket-money; and, wondering what they should buy, they dressed themselves in their holiday clothes, and set out with their father and mother to the fair.

It was surprising how far silver pennies went in those days; but before evening twelve of the thirteen had got rid of their money. All had provided themselves with bargains except Merrymind.

The cause of the silver penny remaining in his pocket was that he had set his heart upon a fiddle; and fiddles enough there were at the fair, but there was not one that cost so little as a silver penny.

There was a stall of fiddles kept by a young merchant from a far country, who had many customers, his goods being fine and new; but near by sat a little grey-haired man, at whom everybody had laughed that day, because he had nothing on his stall but one old dingy fiddle, and all its strings were broken.

"Buy a fiddle, my young master?" he said, as Merrymind came forward. "You shall have it cheap; I ask but a silver penny for it; and if the strings were mended, its like would not be found in the whole of the north country."

Merrymind thought this a great bargain. He was a handy boy, and could mend the strings while watching his father's sheep. So down went the silver penny on the little man's stall, and up went the fiddle under Merrymind's arm.

"Now, my young master," said the little man, "if you help me to pack my stall, I will tell you a wonderful piece of news about that fiddle. It is certain the strings can never be mended, nor made new, except by threads from the night-spinners, which, if you get, will be a good pennyworth."

Merrymind made haste to join the rest of the family, who were soon on their way home. When they got there everyone showed his bargain, and Merrymind showed his fiddle; but his brothers and sisters laughed at him for buying such a thing when he had never learned to play. His sisters asked him what music he could bring out of broken strings; and his father said:

"You have shown little prudence in laying out your first penny, and I fear you will never have many to lay out."

Merrymind tried to repair the strings; but, true to the little man's parting words, no string would hold on that fiddle.

In the meantime, Merrymind lost credit at home, and, as nobody cared for him except his mother, he resolved to go to seek his fortune.

So Merrymind set out one summer morning, with the broken-stringed fiddle under his arm.

There were no highways then in the north country, so Merrymind went over the fair ground and over the hill. On the other side it was steep and rocky, and, after a hard scramble down, he came to a narrow glen all overgrown with wild furze and brambles.

Merrymind was weary with his 'ong journey, and stood thinking of what path to choose, when, by the way of the valley, there came an old man as tall and large as any three men of the north country. On his back he carried a heavy burden of dust, heaped high in a great basket.

"Listen to me, you lazy fellow!" he said, coming near to Merrymind. "If you take the way through the wood, I know not what will happen to

you, but if you choose this path, you must help me with my basket.

"Well, father," said Merrymind, "you seem tired, and I am younger than you, so, if you please, I will help you to carry the basket along the road."

Merrymind began to sing an old rhyme which his mother had taught him. By this time they had entered the valley, and the night had fallen very dark and cold. The old man ceased scolding, and Merrymind saw that they were close

"BUY A FIDDLE, MY YOUNG MASTER?" SAID A LITTLE GREY-HAIRED MAN TO MERRYMIND

Scarce had he spoken when the huge man caught hold of him, firmly bound one side of the basket to his shoulders, and never ceased scolding and calling him names as they marched over the stony ground together. It was a rough way, and a heavy burden, but to a deserted cottage, for its door stood open. Here the old man paused, and loosened the rope from his own and Merrymind's shoulders.

"For seven times seven years," he said, "have I carried this basket, and no one ever sang while helping me

before. Where will you sleep—by my kitchen fire or in that cold cottage?" Merrymind thought he had had quite

"LISTEN TO ME, YOU LAZY FELLOW!" HE SAID

enough of the old man's society, and therefore answered without hesitation:

"The cottage, good father, if you please."

Merrymind stepped into the deserted cottage. The hearth looked as if there had not been a fire there for years. Not a single article of furniture was to be seen. But Merrymind was very tired, and, lying down in a corner, with his fiddle close by, he fell fast asleep.

The floor was hard, and his clothes were thin; but all through his sleep there came a sweet sound of singing voices and spinning-wheels, and Merrymind thought he must have been dreaming when he opened his eyes next morning. He ate half a barley cake, drank from a stream close by, and went out to see the valley.

It was full of people, and they were all busy in houses and in fields, in mills and in forges. The men hammered and dug; the women scrubbed and scoured; the very children were hard at work; but Merrymind could hear neither talk nor laughter among them. Every face looked careworn and cheerless, and every word was something about work or gain.

Merrymind thought this strange, for everybody appeared rich. The women scrubbed in silk, the men dug in scarlet clothes. Crimson curtains, marble floors, and shelves of silver cups were to be seen in every house; but their owners took no pleasure in them, and everyone laboured, as it were, for life.

In the middle of the valley there stood a stately castle. The gates were open, and Merrymind ventured in. In the highest tower of that busy castle, at a window from which she could see the whole valley, there sat a noble lady. Her dress was rich, but of a dingy drab colour. Her hair was iron-grey; her look was sour and gloomy. Round her sat twelve maidens, spinning on old distaffs; and the lady spun as hard as they; but all the yarn they made was jet black.

No one in or out of the castle would speak to Merrymind, or answer his questions. Everyone was too busy. All day Merrymind wandered about with his broken-stringed fiddle, and all day he saw the great old man marching round and round the valley with his heavy burden of dust.

In the evening, near the deserted cottage, Merrymind met the old man.

"Good father," he said, "tell me what games the people of this valley have."

"Games!" cried the old man, in great anger. "There are no games in Dame Dreary's land, I can assure you."

THEY WERE ALL BUSY IN HOUSES & IN FIELDS

That night the boy did not sleep so well, but he was sure there had been singing and spinning near him all night.

Next day a heavy mist shut out sun and sky; the same hard work went forward wherever he turned his eyes; and the great old man with the dust-pannier strode on his accustomed round. Merrymind wandered away till he came to the farthest end of the valley.

"Hold my pipe, and I will tell you," said the soldier, "for nobody else will take the time. The valley belongs to the lady of yonder castle, whom, for seven times seven years, men have called Dame Dreary. She had another name in her youth—they called her Lady

"HONOURABLE LADIES, I PRAY YOU GIVE A POOR BOY A THREAD TO MEND HIS FIDDLE-STRINGS."

There, there was no work, for the land lay bare and lonely, and was bounded by grey crags, as high and steep as any castle wall. There was no passage or outlet, except through a great iron gate secured with a heavy padlock. Close by it stood a white tent, and in the doorway a tall soldier, with one arm, stood smoking a long pipe. He was the first idle man Merrymind had seen in the valley, and his face looked to him like that of a friend; so the boy said:

"Master soldier, will you please tell me what country is this, and why do the people always work so hard?"

Littlecare; and then the valley was the fairest spot in all the north country. Strongarm, the last of the giants, kept the pine forest, and hewed logs out of it, when he was not sleeping in the sun.

"Two fair maidens, clothed in white, with silver wheels on their shoulders, came by night, and spun golden threads by the hearth of every cottage. The people had merry times. All that was changed, nobody knows how, for the old folks who remembered it are dead. Some say it was because of a magic ring which fell from the lady's finger; some because of a spring in the

castle court which went dry. However it was, the lady turned Dame Dreary. The fairies departed; the giant Strongarm grew old, and took up a burden of dust; and the night-spinners were seen no more in any man's dwelling. They say it will be so till Dame Dreary lays down her distaff and dances; but all the fiddlers of the north country have tried their merriest tunes to no purpose."

"If my fiddle were mended, it would be a good thing," said Merrymind. And he then went home to sleep in the deserted cottage.

It was late when he came near it, and the moonlight night looked lovely beside the misty day. Merrymind thought it was a good time for trying to get out of the valley. There was no one about, and no appearance of the giant; but as Merrymind drew near to where the two paths met, there he was fast asleep. He tried to steal past; but Strongarm started up, and pursued him with stones half-way back to the old cottage.

Merrymind was glad to run the whole way for fear of him. The door was still open, and the moon was shining in; but by the fireless hearth there sat two fair maidens, all in white, spinning on silver wheels, and singing together like the larks on a May morning. Merrymind could have listened all night; but he suddenly thought that these must be the night-spinners, whose threads would mend his fiddle; so he said:

"Honourable ladies, I pray you give a poor boy a thread to mend his fiddle-strings."

"For seven times seven years," said the fair maidens, "have we spun by night in this deserted cottage, and no mortal has seen or spoken to us. Go and gather sticks through all the valley to make a fire for us on this cold hearth, and each of us will give you a thread for your pains."

Merrymind took his broken fiddle with him, and went through all the valley gathering sticks by the moonlight; but so careful were the people of Dame Dreary's land that scarcely a stick could be found, and the moon was gone before he was able to come back with a small bundle. The cottage door was still open; the fair maidens and their silver wheels were gone; but, to his great surprise, on the floor where they had sat lay two long threads of pure gold.

THE DAME DANCED WITH ALL HER MIGHT

Merrymind first heaped up his wood on the hearth, to be ready against their coming at night, and next took up the golden threads to mend his fiddle. Then he learned the truth of the little man's saying at the fair, for no sooner were the strings fastened with those golden threads than they became firm. The old dingy fiddle, too, began to shine and glisten, and at length it was golden also. This sight made Merrymind so joyful that, unlearned as he was in music, the boy tried to play. Scarcely had his bow touched the strings when they began to play of themselves the same pleasant tune which the night-spinners sang together.

"Some of the workers will stop for the sake of this tune," said Merrymind; and he went out along the valley with his fiddle.

The music filled the air; the busy people heard it; and never was such a day seen in Dame Dreary's land. The men paused in their delving; the women stopped their scrubbing; the little children dropped their work, and everyone stood still in their places while Merrymind and his fiddle passed

on. When he came to the castle, Dame Dreary's distaff stood still in her hand. Merrymind played through the halls and up the tower stairs. As he came near, the dame cast down her distaff, and danced with all her might. All her maidens did the like; and as they danced she grew young again. They brought her the dress of white and cherry colour she used to wear in her youth, and she was no longer Dame Dreary, but the Lady Littlecare, with golden hair and laughing eyes.

Then a sound of merry-making came up from the whole valley. Strongarm tossed the basket of dust from his shoulder, and lay down to sleep in the sun. That night the fairies danced on the hill-tops; and the night-spinners, with their silver wheels, were seen by every hearth. Everybody praised Merrymind and his fiddle; and when news of his wonderful playing came to the king's ears, he promoted Merrymind to be his first fiddler, which, under that wise monarch, was the highest post in his kingdom.

As soon as Merrymind's family and neighbours heard of the high position his fiddle had gained for him, they thought music must be a good thing, and man, woman, and child took to fiddling. It is said that none of them ever learned to play a single tune except Merrymind's mother, on whom her son bestowed many nice presents.

HOW THE MAIL COACH BEGAN

THERE was a man living in Bath at the end of the eighteenth century whose name was John Palmer. He owned a theatre in the city, and was considered a very go-ahead person. But there was one thing that vexed him, and that was the dreadful slowness of the coaches; for in those days a coach hardly got farther in an hour than a walker might do with some energy.

"However incredible it may seem," said a proud coach advertisement of that time, "this coach will actually—barring accidents—arrive in London four days and a half after leaving Manchester." Now, John Palmer often wanted to get a great actor from London to come and act in Bath, and the long journey by coach again and again prevented this. So Palmer thought things out, and finally hit upon a plan.

It came to him that the Government should start a number of coaches to carry the mails, and that these coaches should be built for speed and horsed by the fastest-trotting animals in the country. He worked out his figures, and proved that the Government, by building its own coaches and carrying its own mails, would save large sums of money.

Sure of success, he went to London and interviewed the heads of the Post Office. But these gentlemen only smiled at the idea. It would never work properly, they said. It was a dream; it was not possible in a workaday world. Coaches, it must be remembered, were almost a new invention; and before those days even noblemen could only travel in a "waggon"—a rough cart, without springs. Queen Elizabeth rode from Greenwich to London behind her Lord Chancellor on the same horse! So the coach which travelled at four miles an hour was considered at that time to be a very fine invention, and the Post Office authorities laughed at John Palmer.

John Palmer, however, stuck to his idea, and succeeded in getting the great statesman Pitt to consider it. Pitt soon saw the immense benefits promised by this scheme, and undertook to carry it out. The first mail coach left London at eight o'clock in the morning on August 8, 1784, and arrived at Bristol at eleven at night. The public received the new reform with acclamation, and the Government saved $100,000 a year.

If it had not been that John Palmer wanted to get London actors to his theatre in Bath, this great reform would certainly have been delayed for many years.

It is difficult for us to imagine, in these days of railway trains and motor-cars, what it was like when queens rode on horseback, or when it was considered incredible for a coach to get from London to Manchester in four and a half days. John Palmer's mail coaches lasted even after the railway had made its appearance.

THE NEXT STORIES ARE ON PAGE 4513

Popocatepetl, or "Smoking Mountain," the great volcano of Mexico, which is nearly 18,000 feet high.

MEXICO AND CENTRAL AMERICA

CONTINUED FROM 4262

ARMS OF MEXICO

We will sail later in imagination with Columbus about the Caribbean Sea, and picture to ourselves the clear water, and the lovely islands and shores that enclose it. These islands are very beautiful, and well worth visiting. We now want to pass into the neighbouring gulf, to mount into the country of Mexico, to look closer at the irregularly shaped bridge of land, Central America, that joins the great north and south continents of the New World.

Let us look carefully at the shape of the gulf, into which the Father of Waters, the Mississippi, and the Great River of the North, the Rio Grande del Norte, pour the southern drainage of North America. The two peninsulas of Yucatan and Florida shut it in like doors, and Cuba lies between them. Columbus, in his journal, wrote of Cuba: "This is the most beautiful island eyes ever beheld. One could live here for ever."

Let us notice, too, the way in which the vast bulk of North America tapers through Mexico to Central America. We must next make sure that we see clearly that Central America consists of four narrow isthmuses, with bulging masses of land between them. The most important of the four are Tehuantepec, 125 miles across, where North America ends, though Yucatan and a small neighbouring state are included in Mexico, and Panama, only about 35 miles across, beyond which South America begins. Then let us pause for a moment's thought about the mighty mountain chain stretching, under different names, for thousands of miles from Alaska in the far north, to the extreme tip of the pear-shaped southern continent. There are many volcanoes in this long chain, especially about the middle of it, in Central America and Mexico. At Panama the great heights sink to about 3,000 feet, and the pass, or saddle, between these low mountains is less than 300 feet high. To the west of the mountains lies the vast expanse of the Pacific Ocean.

Four hundred years ago no one could have given this simple description of the position of Mexico and Central America. Columbus died fully believing that the land he discovered was part of Asia; it was only by degrees, as his successors cruised about the low-lying shores of the gulf and the sea, as they caught glimpses of the ocean beyond, as they sought, ever in vain, to find a way for their ships through Central America to that

ocean, that the truth came to them that they were not on the fringe of Asia, but on a great continent which lay between them and their desires. How one envies them the first entrancing sight of the Pacific Ocean from Panama!

THE GOLDEN LAND THAT LAY BEYOND THE WESTERN SEAS

Wonderful rumours, spread by these adventurous spirits soon reached Cuba, one of the first islands settled by the Spaniards. There were stories of massive temples and great stone idols; of large towns with thousands of busy workers; of people with rich clothes and great possessions in gold and silver and jewels.

All these, they said, were to be found inland from the shores of the gulf. Daring deeds were daily occurrences in the sixteenth century, but one of the most romantic and desperate expeditions ever planned and carried out was that of the brilliant Spanish commander, Cortes, to test the truth of these rumours, and to annex whatever he might find for his emperor, Charles the Fifth of Spain, just twenty years after the death of Columbus.

Eleven ships, carrying 400 Europeans, 200 natives, 16 horses, and 14 guns, seems but a small force with which to attempt a passage into an unknown land. But Cortes, who wrote history with his sword, knew no fear, and pushed forward in spite of all obstacles. We long to follow him every foot of the way, but must be content with glimpses of his bravery and dash; with the mere mention of the shipwrecked captive Spaniard and the lovely native girl who acted as interpreters.

As the wonderful story unfolds, we see the founding of the port of the True Cross—Vera Cruz—the friendliness of the tribes near the coast, the famous beaching and burning of all the ships, save one, that had brought the expedition, so that none could retreat.

THE WONDERS OF THE LAND OF ROMANCE TO WHICH CORTES LED HIS MEN

The best one was spared to send home to Spain with news and specimens of the work and treasures of the country. There is a case of treasures, such as Cortes sent home, in the American Room of the British Museum; among them are wonderful masks in turquoise mosaic, a crystal skull, a two-headed blue serpent, and some most interesting picture writing. On and on toiled the party from the hot, unhealthy lands by the sea, with its tangle of tropical vegetation, up the rugged country which leads by high terrace steps to the great plateau of Mexico, 7,000 feet and more above the level of the sea.

What a treat was the pure, cool air, the grand sight of the snow-topped volcanoes before them, and how astonished were the travellers at the prickly cactus hedges, and the cultivated fields and fine forests and lakes, and the wealth of bright flowers on every side! Surely the plateau and its ridges of mountains must have reminded the Spaniards of their far-away home country, and given them courage to venture on, so as to add to her dominions and glory.

Montezuma, the ruler of this fair country belonging to the Aztec or Mexican race, had more than once sent presents and messages to Cortes, begging him to go away. But Cortes went steadily on till he reached the city of Tenochtitlan, the ancient city of Mexico, on the great lakes that lay in the midst of the plateau.

THE TERROR OF THE AZTECS WHEN THE WHITE MEN CAME AMONG THEM

The Aztecs were terrified at the pale faces of the Spaniards, at the horses and guns, none of which they had seen before, and they seem almost to have believed that Cortes was the white war-god of their legends come back as he had promised centuries before, for the guns appeared to them to flash lightning, and the horses to travel like the wind. If Cortes was disappointed with Tenochtitlan, he did not say so in his letters home, but enlarged on the glory and splendour of the city, its temples and buildings, its cypress-crowned hill, Chapultepec, with its magnificent view.

It was not long before Cortes got Montezuma entirely into his power. So great was the tact and resource of the great commander, that it seemed as if all were about to be peaceably arranged for the transfer of the country and its government. But Cortes had to return for a time to Vera Cruz, and his deputy at Tenochtitlan enraged the Aztec people with his cruelty. Cortes returned only just in time to save his forces from utter destruction.

Montezuma, still a prisoner, was persuaded by the Spaniards to speak to his subjects, and urge them to stay their attack on the strangers. An impressive sight he must have looked standing on the flat roof of the palace, dressed in his blue and white mantle, his blazing jewels, fine crown, and golden sandals dazzling in the sun. But the moment of surprised stillness caused by his appearance passed, and the furious people, refusing to listen longer, flung arrows and stones in a great tumult. Montezuma—their king—was fatally wounded during this encounter.

MEXICO AND CENTRAL AMERICA, THE LINK THAT JOINS TWO GREAT CONTINENTS

The day after his death, when things looked black indeed for the Spaniards, Cortes cut his way out of the capital in the darkness. This was known as the "sad night." Men and horses perished in numbers on the narrow path by the waters of the canal and lake, and, when the remnant gathered together in the country beyond, Cortes wept tears of despair.

But the genius of the leader shone only the brighter for this check. Somehow he managed to rally his forces, and within a week he utterly defeated the brave Aztecs, who came out to withstand him. They fled in confusion, more than ever convinced that he must be a god, and not a mere man. Within eight months, by means of help from neighbouring tribes, and by unheard-of efforts in organising an army and arranging for its keep and transport, the beautiful plateau of Mexico, with its ruined capital, Tenochtitlan, was under the power of Cortes. When the town rose again by the lake, it was as the City of Mexico.

The country, for a while, was put under military rule, and became part of the huge dominions which so oppressed the weary emperor, Charles the Fifth, of Spain, Austria, and the Netherlands. Cortes was not content with these successes. He made many explorations in Central America, always hoping to find a way through to the Pacific.

By degrees more colonies for Spain were founded, in Yucatan and Honduras, and in other parts of the land, whose secrets were revealed by the energy of the great commander and his officers. Cortes even pushed up the long, narrow Gulf of California, and before long the Spaniards had also found their way far beyond the plateau of Mexico in all directions. The history of the peoples whom the Spaniards found in Mexico and Central

America has not yet been fully unravelled. Scholars are still at work studying the wonderful ruins of temples that are discovered from time to time, the carvings on great stone idols and altars, and the picture writing on various relics. Some of these we can see for ourselves in museums, and interesting it is indeed to trace resemblances in them to the work of other countries, such as Egypt and Babylon and China.

THE MYSTERY OF THE FIRST PEOPLE WHO SETTLED IN AMERICA

Where the first people came from to settle in America, we know not, but the remains found on the soil show that, through the long centuries before the vast lands were discovered by Europeans, different races of people had lived and died on them for generation after generation. Sometimes they destroyed the works of those who went before them; sometimes they grafted their own stock and works upon those of their predecessors. In time we hope to understand more about these shadowy tribes, about the Toltecs and their interesting legends, about the Mayas and their high civilisation, about the Aztecs and their curious picture writing, and their settlements on the plateau of Mexico after centuries of wandering.

When Cortes went to Honduras, he passed, all unknowingly, a wonderful palace of the Mayas, hidden by the thick growth of trees and shrubs. As relics are found they are carefully studied, with a view to trace the various customs, beliefs, and histories of the old peoples and tribes who for thousands of years had been making progress in civilisation, not only unknown to the dwellers in the Old World, but equally strange and unknown in many cases to other dwellers in their own world, which we have come to call the New.

THE GREAT ZEAL OF THE SPANIARDS TO CONVERT THE HEATHEN AZTECS

As we know, the Spaniards classed the natives they found in the New World all together under the mistaken name of Indians. Now, the civilisation and conversion to the Christian faith of these so-called Indians was one of the chief objects of the Spanish conquerors. Bands of devoted missionaries went out from Europe to the new possessions to teach the natives to give up their wild, roving life and the heathen customs of their religion, such as offering human sacrifices to idols.

Cortes himself did his best to persuade Montezuma to accept Christianity, but the Aztec chief was only puzzled by the new ideas so hastily thrust upon him. Everywhere, in the first zeal of overthrowing heathenism, idols and temples, inscriptions and carvings were cast down, buried, defaced; so that the task of finding out the truth about the past has been made even harder than it might have been.

But, deep as is the wonder and interest of the story of the old New World, of the early peoples in Mexico and Central America, as shown by the works of their hands, romantic as is the story of the introduction of the natives to the Spaniards, the growth of the country under Spain is still more interesting; and even more thrilling and romantic than the conquest of Cortes are the events of the last hundred years.

THE TERRIBLE CRUELTIES OF THE SPANISH CONQUERORS IN AMERICA

As the years passed on, the native races settled down—after many difficulties—to the new religion and new rulers. The new teaching seemed very strange to the simple-minded Indians, and the priests had much difficulty in explaining the Christian religion to them. They were much hindered by the reckless searchers for gold, many of whom were cruel and selfish and did not regard the rights of the Indians. Viceroys were sent out from Spain during three centuries to govern—or misgovern—in the king's name, sixty-four of them in all.

Some were good and kind, some terribly the reverse. Throughout these years the missionary priests were hard at work trying to influence the natives towards a spirit of quiet obedience; the devoted priests taught their charges improved methods in agriculture as well as religion. Many beautiful towns were founded after Spanish models, with Spanish names and fine cathedrals; schools and colleges rose up in them, and Spanish families went out to make new homes in the Far West.

Roads and bridges made travel and trade easier. As agriculture was extended and improved, mining and forestry were developed, and the raising of cattle then became an important industry.

SPANISH & FRENCH INVADERS OF MEXICO

There is scarcely another story in all history so romantic as that of the Spanish conquest of Mexico in the sixteenth century. With an army of 400 European soldiers and 16 horses, both of which numbers were afterwards slightly increased, Cortes, the Spanish commander, set out to conquer a mighty empire. He had to meet a whole nation in arms; but, when disaster seemed certain, Cortes, by ability and skill, routed the Mexican army at the famous battle of Otumba, as shown here, and later subdued the whole country for his emperor.

More than three centuries after the Spanish conquest of Mexico, the country was again invaded. The Emperor Napoleon III. of France, making the unjust treatment of foreigners in Mexico an excuse, declared war in 1862, and forced an emperor of his own choosing, the Archduke Maximilian of Austria, upon the country. In 1867, however, the French troops had to withdraw from Mexico, and, three years after, Maximilian was shot by the republican party. In this picture we see the French army, under Marshal Bazaine, entering the city of Mexico.

Both Mexico and Central America offer vast possibilities in all these directions. Round the tropical lowlands, rice, sugar, cocoa, and cotton grow easily. On the rising terraces, coffee, maize, and tobacco find suitable conditions, and wheat-fields lead up to the grassy downs, which make good pasture land for the cattle and the splendid horses, for which the country gradually became famous as the years went by.

THE VAST NATURAL RICHES FOUND IN THE FORESTS AND MINES OF MEXICO

The magnificent forests abound with every valuable kind of tree, from the rubber tree to the mahogany. As for the mines, Mexico is rich in various kinds of metal—silver, gold, copper, and lead, among many others. Sulphur is obtained from the crater of the smoking mountain, Popocatepetl. Another remarkable volcano is Jorullo, thrown up by an earthquake in a single night in 1759, from fertile fields of sugar and indigo.

In time, many Spaniards intermarried with the natives, particularly in Central America; and so many great men of these countries are descended from the conquered, as well as from the conquerors, and a large mixed nation has grown up, with a certain number of pure-blooded Spaniards at the top of society, and many natives "of no account" at the bottom. New Spain gradually came to include nearly all the country round the Gulf of Mexico, and reached out northward to California, though the outlying districts were very thinly peopled.

Spain ever needed all she could get out of her distant provinces, for her wars at home were constant in the seventeenth and eighteenth centuries. Under some viceroys the taxes were excessive, and the people were oppressed in order to send riches to Spain; but under other viceroys the rule was milder, and sometimes even indulgent.

HOW HIDALGO BEGAN THE STRUGGLE THAT ENDED IN MEXICO'S FREEDOM

When the feeling of revolt against tyranny was voiced in different countries, and the longing for independence and freedom ever grew stronger, until it found expression in the American and French Revolutions, about which we will read later in this work, Mexico, too, realised its hardships. A time of struggle began against rule from overseas, which lasted for many years. Hidalgo, born five years after the Boston tea-party, was one of the first Mexicans to say boldly that he wanted Mexico to be Mexico, not a helpless dependency of Spain.

When he and his little band of friends dared to raise their banner with the cry, "Up with true religion; down with false government!" it was an unheard-of thing that any ordinary man of the country—not appointed by Spain to office—should venture even to express an opinion. Hidalgo, a man of the people, boldly worked for government by the people. The end of a most exciting campaign of nine months was apparent failure, for Hidalgo and his companions were taken prisoners and shot, and their heads for ten years remained fixed on spikes at the corners of a large building in Guanajuato, a rich and flourishing city in the second largest mining province in Mexico.

THE SAD END OF THE HEROES WHO TRIED TO SET MEXICO FREE

The people who lived in those times no doubt thought Hidalgo had failed. We who live a hundred years later know that he succeeded gloriously in awaking his countrymen, and preparing the ground for the great struggle that was coming. To-day, in front of the building where his dead lips preached to all that passed by, there now stands a bronze statue of "Hidalgo, the first liberator of his country."

The next great name is that of Morelos, who, three years after the execution of Hidalgo, was leading the Independents from victory to victory, on the Pacific coast, in the picturesque country of lower levels, shaded with the banana and orange trees, and on the higher plateau, taking towns or defending them, forming a congress, and sending out a declaration of independence, as their northern neighbours had done some years before.

But the tide turned, and in 1815, six months after Napoleon lost his last battle, Morelos, who had much of the ability, without the opportunities, of the Upsetter of the Peace of Europe, was in his turn taken prisoner and shot. The Royalists hoped that now the troublesome new ideas were stamped out. How little they knew! The

SCENES IN THE SUNNY LAND OF MEXICO

This Mexican railway runs through a prehistoric cutting that has been utilised by the engineers of to-day. The cutting was hewn entirely by hand labour in the old days before Europeans went to Mexico. It is said that the rails are laid on ebony sleepers, and that the ballast used is silver ore from the disused mines of the old Aztecs.

*Here we see natives of Tehuantepec, who are mostly of Indian blood. The women are making and cooking bread.

In this picture a Guatemalan sugar plantation is shown. In the distance we can see the famous Volcano de Agua.

*The cutting of the Panama Canal, which will divide the New World in two, as shown on page 3819, is, perhaps, the most wonderful engineering feat ever attempted. Here we see a very difficult cutting being made through the solid rock at Culebra. Less than a century ago such an undertaking would have been laughed at as a dream.

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heroic, patriotic Morelos, whom they treated with insult and shot, is now adored by the Mexican people. They know that the attention of the mass of the people, first awakened by Hidalgo, was fully aroused by the life and sacrifice of Morelos. He showed them, as well as the world looking on, that the old Mexican blood was capable of great deeds, and that freedom for the country was no mere dream.

We look in vain on the map for the city in which he was born under the name it bore at that time, Valladolid, for it has since been renamed, as well as the state of which it is the capital, "Morelia," after its greatest citizen.

For some time after the death of Morelos, ideas of independence worked and grew chiefly in secret, in the mountains and in far-off spots. Presently a change came about, which gave the Mexicans a chance to ask for more freedom.

THE JOY WHEN MEXICO WAS AT LAST FREED FROM THE YOKE OF SPAIN

When the King of Spain, as we read on page 3361, was obliged to give way to liberal demands in the mother country, to abolish the hated Inquisition, to give freedom to the Press, great rejoicings took place in the colonies, and a new leader appeared on the scene—Yturbide, of Mexican blood, hitherto an officer in the Royalist army. A wide-spread revolution burst out all over the country, in which not only the insurgents took part, but many of the Spanish as well as Mexican chiefs, who declared for independence.

Yturbide hastened to meet the last governor ever sent from Spain at Vera Cruz, and soon convinced him that his services were not needed as viceroy. The outcome of their conference was the Treaty of Cordova, which settled the independence of Mexico. Yturbide made a triumphal entry into the capital at the head of the Independents, and so ended, amidst scenes of wild enthusiasm and rejoicings, the Spanish rule three hundred years after the arrival of Cortes.

The present national flag, with its white for purity, green for union, red for independence, stands for the three articles of the national faith settled at this time. The device of the eagle and serpent on a cactus-bush refers to an old story connected with the settlement of the old Aztec tribes on the plateau. Many Spaniards went home now, and opinions were greatly divided among those who remained as to whether the government should be a monarchy or a republic. Yturbide, who had much love of splendour and state, as well as personal ambition, managed to arrange his position as Emperor of Mexico, but only for a few months.

THE MAN WHO MADE HIMSELF EMPEROR AND WAS SENTENCED TO BE SHOT

In the end he, too, was sentenced to be shot; but when angry feeling had subsided, his faults and failings were forgotten, and his countrymen recognised that it was his act that had freed Mexico from the control of Spain. Over the house of his birthplace—he was a fellow-townsman of Morelos—is the inscription: Libertador de Mexico, meaning Liberator of Mexico.

A very confused time followed. Revolutions and different forms of constitutions and plans of government rapidly followed each other. There was one man, whose name stands out in the confusion, who was mixed up in every event of these troublous years. This was Santa Anna, first making his name as a soldier fighting in the wars of independence and expelling the Royalists from Vera Cruz, when Spain made its first and last attempt to win back Mexico. He was elected president in 1833.

It was about that time that troubles began with Texas, a district as large as France, on the Gulf of Mexico. Three hundred families had gone to colonise it from Mexico a few years before, and a large number of Americans had also settled there on grants of land. An insurrection against the oppressive Mexican government broke out, which ended in the Texans becoming independent for a period of about ten years, and then it was annexed to the United States by treaty, and admitted to the union very soon after.

THE WAR BETWEEN MEXICO AND THE UNITED STATES ABOUT TEXAS

We remember how many people in the United States were against this union, because the laws of Texas allowed slavery; also many people in the States thought a war with Mexico would follow if Texas were annexed, as Mexico had never given up hope of reconquering

CUTTING THROUGH A MOUNTAIN

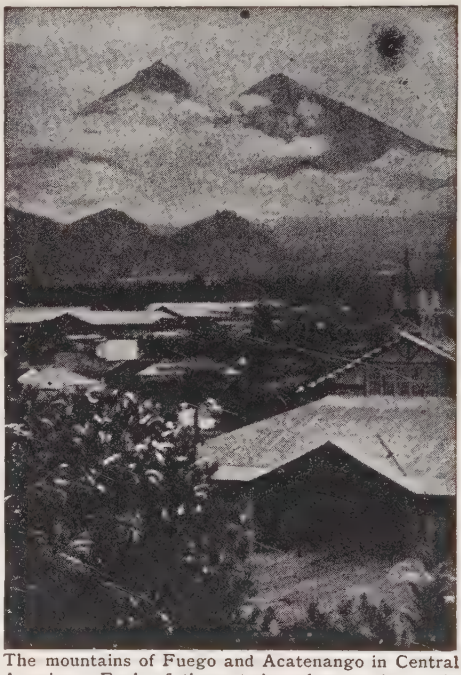
Sometimes so much rain falls on the Isthmus of Panama that the slope of the ground cannot carry it off quickly. When one of these floods comes, all work in the low places must stop or the men would be drowned. Here we see a few men examining the condition of the work after the rain has ceased. The difficulty of cutting the Suez Canal was nothing in comparison with this.

The Culebra cut, shown in this picture, is one of the most difficult parts of the work. Here a ditch is cut directly across a mountain. You can gain some idea of its depth by noticing how tiny the trains look as they crawl along the shelves of the rock, on the sides which have not yet been cut away.

that state. These opponents were soon seen to be right, and Mexico and the United States were quickly at war. In due time, also, the annexation of so much slave country aroused ill-feeling in the United States, which grew until the end finally was the dreadful Civil War between North and South, which settled the slavery question for ever.

The Mexican War did not last very long. The American troops were well armed and disciplined, and fought steadily. The Mexicans were brave, too, but the long course of revolutions had spoiled both officers and men, and they could not hold their own.

Santa Anna, through these years, had very varied experiences; at one time general in the field, then head of the Government, then in retirement at Havana, then back again to help his country when in dire straits. But his eloquence and enthusiasm, his power of raising money and troops, were all in vain. Vera Cruz was taken, beautiful Pueblo, with its many-coloured tiles glittering in the sun, fell without a blow; even Mexico, the capital, was occupied, after the hill of Chapultepec, so connected with old Mexican history, had been taken after a terrific struggle.



The mountains of Fuego and Acatenango in Central America. Each of these twin volcanoes is nearly 13,000 feet high, but while Fuego is still violently active at times, Acatenango is dormant, or sleeping, and has not belched forth fire and molten rock for centuries.

Santa Anna was there in the most exposed places; the brave boys of the military college on Chapultepec were there, receiving their first lesson in actual warfare. It was indeed a terrible day, with the horrid noise of war and the booming of cannon mingled with the frantic ringing of church bells in the city, encouraging the Mexicans to think that the victory was theirs. The bells were silenced when the shouts of the Americans cheered the tearing down of the old colours and the running up of the new on the stronghold, the ancient hill of Chapultepec. This was practically the end of the Mexican War.

After peace had come to the long-distracted country, there was a short time of quiet, when reforms were beginning to take effect, and then troubles and quarrels broke out again. These were bad enough for three European Powers to make them an excuse for interference. England and Spain soon withdrew their remonstrances, but Napoleon III., wishing for military glory, managed to set up a European prince, Maximilian of Austria, brother of the Emperor Francis Joseph, as Emperor of Mexico, to be supported by the arms of France. His short reign of three years is indeed a tragic story. With his young and charming wife, Maximilian set up a gay court in the beautiful palace, restored and furnished in grand style, on the famous hill of Chapultepec. The National Museum in the city close by holds the heavy silver plate, the great glass coach, and many other gorgeous reminders of the brilliant days that passed like a dream, with dinners and dance, and fêtes under the fine trees and among the wealth of sweet roses. The native President Juarez withdrew on Maximilian's entry to the north of Mexico, and bided his time.

Suddenly there came a crash. There had been civil war in the United States while Napoleon III. made his schemes, and the Americans were fully occupied for a time. As soon as it was over, they hastened to remind France that the countries of Europe had no right to interfere with the nations of the American continent, and that they could

THE CITIES AND BUILDINGS OF MEXICO

This building on a rocky hill, surrounded by cypress-trees, is the palace of Chapultepec, and was formerly the home of Mexico's rulers. It stands on the site of Montezuma's palace, and is now used as Government offices.

The splendid cathedral in Mexico city was begun in 1573 and completed 84 years later. Its walls alone cost $2,500,000; inside there are twenty separate chapels

Zacatecas, shown here, is a centre of silver-mining. On the left can be seen the cathedral, with one ruined tower, that was damaged by cannon-shots in the revolution.

Guanajuato, of which we see a general view in this picture, is a great mining capital, and is situated on both sides of a deep ravine with a mountain stream running through it, that in rainy weather becomes a torrent.

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not recognise a monarchy in Mexico. Napoleon was afraid to venture on a war with the United States, so he was compelled to withdraw the help in money and soldiers he had promised to Maximilian, to keep him on the throne that he had persuaded him to accept.

AN EMPRESS WHO LOST HER REASON AND AN EMPEROR WHO LOST HIS THRONE

The poor Empress Carlotta rushed off to Europe to try what personal pleading would do with Napoleon and with the Pope, but she failed to move either. The strain and sorrow of it sent her out of her mind, and she has never recovered. Maximilian refused to give up the throne or to leave the country. He was taken prisoner and shot.

As the French left the country, and the empire they had created drew to its tragic end, one of the greatest of Mexican liberators was making his way to the front. This was General Porfirio Diaz, who took possession of the capital for the Liberals in 1867. Less than a month later the patient, long-enduring Juarez entered it in solemn state. Four years after the death of Juarez, Santa Anna died, poor, blind, and neglected. Though possessing great bravery and military skill, he had always been turbulent and difficult, and often did his country harm instead of good.

Diaz became president first in 1877, and was re-elected seven times, but in 1911 was forced to resign, and lived in Europe till his death in 1915. During his long rule he made vigorous efforts to extend trade and commerce, and to increase the wealth of his country. Shortly after his resignation, he was succeeded by Francisco I. Madero. A revolution, planned by Felix Diaz, a nephew of the former president, was aided by an uprising of soldiers, and President Madero was shot early in 1913. The leader of the soldiers, General Victoriano Huerta, assumed control, but was forced to retire, and Venustiano Carranza became president.

HOW THE TRAIN NOW RUNS ALONG THE ROAD WHERE CORTES LED HIS ARMY

Railways now connect the United States with Mexico, and the iron horse climbs the romantic route of Cortes and his train, from the coast to the plateau, by means of most difficult engineering. A great line is also built across the Isthmus of Tehuantepec, connecting the Atlantic and Pacific, and lines also cross the other isthmuses of Central America. Spanish rule lasted in Mexico for about three centuries, and was thrown off about one hundred years ago. Several independent republics have since been formed: Guatemala and Nicaragua, Honduras, Costa Rica, Salvador, and Panama.

None of these is as large as England and Wales, and Panama, the youngest of the republics, is about the size of Ireland. The productions of these countries are very like those of Mexico; the governments are not yet so settled. Both earthquakes and revolutions are very common occurrences in Central America.

There is already a railway across the narrowest isthmus—Panama—but the need is so great for ships to pass direct from one ocean to the other that for many years efforts have been carried on to make a canal. Great dams and locks are in process of building, and giant steam-shovels are working away, digging out tons of earth and rock after it has been loosened with dynamite.

THE CANAL THAT WILL CUT THROUGH TWO CONTINENTS AND JOIN TWO OCEANS

The most difficult part of the huge undertaking is the cutting, seven miles long, 250 feet deep, through the hard rock of Culebra Pass between the hills. More is told of the Canal on page 5631.

We need only glance at the map to see what an immense difference the canal will make, not only in the distance between ports on the east and west of America, but in shortening the world's great highways. Many travellers, from the United States especially, go each year to gaze at 50,000 men at work on the biggest engineering enterprise ever known.

Cortes and the rest gazed ardently on the Pacific from Panama, and did their best to find a natural passage to it through Central America. They would have been filled with wonder at the sight of this artificial river, whose completion will realise their dream, made by the anxious thought of hosts of engineers, and the labour of thousands of workmen, by which ships shall at last pass direct from one ocean to the other.

The next story of Countries is on page 4497.

A BALLAD OF THE BORDERLAND

THE beautiful country, on both sides of the Cheviots, known as the Borderland is a region of green hills and valleys, where the waters of many streams make music as they flow. This Borderland has always been famous for its legends, and many ballads have been collected in which these legends are told. James Hogg gave a new dress of poetry to one of these old legends in his famous ballad of "Kilmeny." The story was an old one long before the poet heard it, and he told it in the beautiful musical way of an old ballad. Kilmeny is a lovely girl lost in the woods, and for seven years her mother mourns her. Then one day she comes home. She is strangely quiet, though, if anything, more beautiful than ever. She had been stolen away by the fairies, as she was so pure and lovely. Then her heart had yearned for her old home, and the fairies let her go back. But after a month and a day Kilmeny wanders again to the greenwood, and, lying down there, the fairies bear her away where everything is as pure and beautiful as Kilmeny herself, and she returns no more.

KILMENY: A FAIRY LEGEND

CONTINUED FROM 4269

BONNY Kilmeny gaed up the glen;
But it wasna to meet Duneira's men,
Nor the rosy monk of the isle to see,
For Kilmeny was pure as pure could be.
It was only to hear the Yorlin sing,
And pu' the cress-flower round the spring;
The scarlet hyppe, and the hindberry,
And the nut that hung frae the hazel-tree;
For Kilmeny was pure as pure could be.
But lang may her minny look o'er the wa',
And lang may she seek i' the greenwood shaw;
Lang the laird of Duneira blame,
And lang, lang greet or Kilmeny come hame!

When many lang day had come and fled,
When grief grew calm, and hope was dead,
When Mass for Kilmeny's soul had been sung,
When the bedes-man had prayed, and the deadbell rung:
Late, late in the gloamin' when all was still,
When the fringe was red on the westlin hill,
The wood was sere, the moon i' the wane,
The reek o' the cot hung o'er the plain,
Like a little wee cloud in the world its lane;
When the ingle lowed with an eiry leme,
Late, late in the gloamin' Kilmeny came hame!

"Kilmeny, Kilmeny, where have you been?
Lang hae we sought baith holt and dean;
By linn, by ford, and greenwood tree,
Yet you are halesome and fair to see.
Where gat you that joup o' the lily sheen?
That bonny snood o' the birk sae green?
And these roses the fairest that ever was seen?
Kilmeny, Kilmeny, where have you been?"

Kilmeny looked up with a lovely grace,
But nae smile was seen on Kilmeny's face;
As still was her look, and as still was her ee,
As the stillness that lay on the emerant lea,
Or the mist that sleeps on a waveless sea.
For Kilmeny had been she ken'd not where,
And Kilmeny had seen what she could not declare;
Kilmeny had been where the cock never crew,
Where the rain never fell and the wind never blew.
But it seemed as the harp of the sky had rung,
And the airs of heaven played round her tongue,
When she spake of the lovely forms she had seen,
And a land where sin had never been:
A land of love, and a land of light,
Withouten sun, or moon, or night;
Where the river swa'd a living stream,
And the light a pure and cloudless beam.
The land of vision it would seem,
A still, an everlasting dream.

In yon greenwood there is a waik,
And in that waik there is a wene,
And in that wene there is a maike,
That neither has flesh, nor blood, nor bane;
And down in yon greenwood he walks his lane.

In that green wene Kilmeny lay,
Her bosom happ'd wi' flowerets gay;
But the air was soft and the silence deep,
And bonny Kilmeny fell sound asleep.
She kenned nae mair, nor open'd her ee,
Till waked by the hymns of a far countrye.

She woke on a couch of the silk sae slim,
All striped wi' the bars of the rainbow's rim;
And lovely beings round were rife,
Who erst had travelled mortal life;
And aye they smiled and 'gan to speer,
"What spirit has brought this mortal here?"

"Lang have I ranged the world wide,"
A meek and reverend fere replied;
"Baith night and day I have watched the fair
Eident a thousand years and mair.
Yes, I have watched o'er ilk degree,
Wherever blooms femenitye;
And sinless virgin, free of stain
In mind and body, fand I nane.
Never, since the banquet of time,

Found I a virgin in her prime,
Till late this bonnie maiden I saw,
As spotless as the morning snaw :
Full twenty years she has lived as free
As the spirits that sojourn in this countrye :
I have brought her away frae the snares of men,
That sin or death she never may ken."

They clasped her waist and her hands sae fair,
They kissed her cheek, and they kemed her hair ;
And round came many a blooming fere,
Saying : " Bonny Kilmeny, ye're welcome here !
Women are freed of the littand scorn :
O, blessed be the day Kilmeny was born !
Now shall the land of the spirits see,
Now shall it ken what a woman may be !
Many lang year in sorrow and pain,
Many lang year through the world we've gane,
Commissioned to watch fair womankind,
For it's they who nurse the immortal mind.
We have watched their steps as the dawning shone,
And deep in the greenwood walks alone ;
By lily bower and silken bed,
The viewless tears have o'er them shed ;
Have soothed their ardent minds to sleep,
Or left the couch of love to weep.
We have seen ! we have seen ! but the time maun come,
And the angels will weep at the day of doom !

" O, would the fairest of mortal kind
Aye keep these holy truths in mind,
That kindred spirits their motions see,
Who watch their ways with anxious ee,
And grieve for the guilt of humanitye.
O, sweet to Heaven the maiden's prayer,
And the sigh that heaves a bosom sae fair.
And dear to Heaven the words of truth,
And the praise of virtue frae beauty's mouth !
And dear to the viewless forms of air,
The mind that kythes as the body fair.

" O bonny Kilmeny ! free frae stain,
If ever you seek the world again,
That world of sin, of sorrow, and fear,
O, tell of the joys that are waiting here ;
And tell of the signs you shall shortly see ;
Of the times that are now, and the times that shall be."

They lifted Kilmeny, they led her away,
And she walked in the light of a sunless day :
The sky was a dome of crystal bright,
The fountain of vision, the fountain of light :
The emerant fields were of dazzling glow,
And the flowers of everlasting blow.
Then deep in the stream her body they laid,
That her youth and beauty never might fade ;
And they smiled on heaven, when they saw her lie
In the stream of life that wandered by.
And she heard a song, she heard it sung,
She kend not where ; but sae sweetly it rung,
It fell on her ear like a dream of the morn :
" O, blest be the day Kilmeny was born !
Now shall the land of the spirits see,
Now shall it ken what a woman may be !
The sun that shines on the world sae bright,
A borrowed gleid frae the fountain of light ;
And the moon that sleeks the sky sae dun,
Like a gouden bow, or a beamless sun,
Shall wear away and be seen nae mair,
And the angels shall miss them travelling the air.
But lang, lang after baith night and day,
When the sun and the world have fled away ;
When the sinner has gane to his waesome doom,
Kilmeny shall smile in eternal bloom ! "

They bore her away, she wist not how,
For she felt not arm nor rest below ;
But so swift they wained her through the light,
'Twas like the motion of sound or sight ;
They seemed to split the gales of air,
And yet nor gale nor breeze was there.
Unnumbered groves below them grew ;
They came, they past, and backward flew,
Like floods of blossoms gliding on,
A moment seen, in a moment gone.
O, never vales to mortal view
Appeared like those o'er which they flew !
That land to human spirits given,
The lowermost vales of the storied heaven ;
From thence they can view the world below,
And heaven's blue gates with sapphires glow,
More glory yet unmeet to know.

They bore her far to a mountain green,
To see what mortal never had seen ;
And they seated her high on a purple sward,
And bade her heed what she saw and heard ;
And note the changes the spirits wrought,
For now she lived in the land of thought.
She looked, and she saw nor sun nor skies,
But a crystal dome of a thousand dyes ;
She looked, and she saw nae land aright,
But an endless whirl of glory and light ;
And radiant beings went and came
Far swifter than wind, or the linkèd flame.
She hid her een frae the dazzling view ;
She looked again, and the scene was new.

She saw a sun on a summer sky,
And clouds of amber sailing by ;
A lovely land beneath her lay,
And that land had lakes and mountains gray ;
And that land had valleys and hoary piles,
And marlèd seas and a thousand isles.
Its fields were speckled, its forests green,
And its lakes were all of the dazzling sheen,
Like magic mirrors, where slumbering lay
The sun and the sky, and the cloudlet gray ;
Which heaved and trembled, and gently swung,
On every shore they seemed to be hung :
For there they were seen on their downward plain
A thousand times, and a thousand again ;
In winding lake, and placid firth,
Like peaceful heavens in the bosom of earth.

Kilmeny sighed and seemed to grieve,
For she found her heart to that land did cleave ;
She saw the corn wave on the vale,
She saw the deer run down the dale ;
She saw the plaid and the broad claymore,
And the brows that the badge of freedom bore ;
And she thought she had seen the land before.

She saw a lady sit on a throne,
The fairest that ever the sun shone on:
A lion licked her hand of milk,
And she held him in a leish of silk;
And a leifu' maiden stood at her knee,
With a silver wand and melting ee;
Her sovereign shield till love stole in,
And poisoned all the fount within.

Then a gruff untoward bedes-man came,
And hundit the lion on his dame;
And the guardian maid wi' the dauntless ee,
She dropped a tear, and left her knee;
And she saw till the queen frae the lion fled,
Till the bonniest flower of the world lay dead;
A coffin was set on a distant plain,
And she saw the red blood fall like rain;
Then bonny Kilmeny's heart grew sair,
And she turned away, and could look nae mair.

Then the gruff grim carle girnèd amain,
And they trampled him down, but he rose again;
And he baited the lion to deeds of weir,
Till he lapped the blood to the kingdom dear;
And weening his head was danger-preef,
When crowned with the rose and clover-leaf,
He gowled at the carle, and chased him away,
To feed wi' the deer on the mountain gray.
He gowled at the carle, and he gecked at Heaven;
But his mark was set, and his arles given.
Kilmeny a while her een withdrew;
She looked again, and the scene was new.

She saw below her fair unfurled
One half of all the glowing world,
Where oceans rolled, and rivers ran,
To bound the aims of sinful man.
She saw a people, fierce and fell,
Burst frae their bounds like fiends of hell;
There lilies grew, and the eagle flew,
And she herked on her ravening crew,
Till the cities and towers were wrapped in a blaze,
And the thunder it roared o'er the lands and the seas.
The widows they wailed, and the red blood ran,
And she threatened an end to the race of man:
She never lened, nor stood in awe,
Till caught by the lions deadly paw.
Oh! then the eagle swinked for life,
And brainzelled up a mortal strife;
But flew she north, or flew she south,
She met wi' the gowl of the lion's mouth.

With a mooted wing and waefu' maen,
The eagle sought her eiry again;
But lang may she cower in her bloody nest,
And lang, lang sleek her wounded breast,
Before she sey another flight,
To play wi' the norland lion's might.

But to sing the sights Kilmeny saw,
So far surpassing Nature's law,
The singer's voice wad sink away,
And the string of his harp wad cease to play.
But she saw till the sorrows of man were by,
And all was love and harmony;
Till the stars of heaven fell calmly away,
Like the flakes of snaw on a winter's day.
Then Kilmeny begged again to see
The friends she had left in her own countrye,
To tell of the place where she had been,
And the glories that lay in the land unseen;
To warn the living maidens fair,
The loved of Heaven, the spirits' care,
That all whose minds unmeled remain
Shall bloom in beauty when time is gane.

With distant music, soft and deep,
They lulled Kilmeny sound asleep;
And when she awakened, she lay her lane,
All happed with flowers in the greenwood wene,
When seven lang years had come and fled;
When grief was calm, and hope was dead;
When scarce was remembered Kilmeny's name,
Late, late in a gloaming Kilmeny came hame.
And O, her beauty was fair to see,
But still and steadfast was her ee!
Such beauty bard may never declare,
For there was no pride nor passion there;
And the soft desire of maiden's een
In that mild face could never be seen.
Her seymar was the lily-flower,
And her cheek the moss-rose in the shower;
And her voice like the distant melodye,
That floats along the twilight sea.
But she loved to raike the lanely glen,
And keep afar frae the haunts of men;
Her holy hymns unheard to sing,
To suck the flowers and drink the spring.
But wherever her peaceful form appeared,
The wild beasts of the hills were cheered;
The wolf played blythely round the field,
The lordly byson lowed and kneeled;
The dun deer wooed with manner bland,
And cowered aneath her lily hand.
And when at eve the woodlands rung,
When hymns of other worlds she sung
In ecstasy of sweet devotion,
O, then the glen was all in motion!
The wild beasts of the forest came,
Broke from their boughts and faulds the tame,
And goved around, charmed and amazed;
Even the dull cattle crooned and gazed,
And murmured and looked with anxious pain,
For something the mystery to explain.
The buzzard came with the throstle-cock;
The corby left her houf in the rock;
The blackbird alang wi' the eagle flew;
The hind came tripping o'er the dew;
The wolf and the kid their raike began,
And the tod, and the lamb, and the leveret ran;
The hawk and the hern attour them hung,
And the merl and the mavis forhooyed their young;
And all in a peaceful ring were hurled—
It was like an eve in a sinless world!

When a month and day had come and gane,
Kilmeny sought the greenwood wene;
There laid her down on the leaves sae green;
And Kilmeny on earth was never mair seen.
But O, the words that fell from her mouth
Were words of wonder and words of truth!
But all the land were in fear and dread,
For they kendna whether she was living or dead.
It wasna her hame, and she couldna remain;
She left this world of sorrow and pain,
And returned to the land of thought again.

OPPORTUNITY

The writer of this short poem was Edward Rowland Sill, an American poet, who died early in life, but who, had he been spared, would probably have been one of the greatest poets the American nation has produced. His theme here is an old one, the contrast between the man who sighs for the opportunity to do great things and the man who does them by seizing whatever means exist, thus making the opportunity. It is an old theme, but the poet, by the sheer pith and compression of his verse, enforces the moral upon our minds as if it were the first time it had been conveyed to us.

THIS I beheld, or dreamed it in a dream—
There spread a cloud of dust along a plain;
And underneath the cloud, or in it, raged
A furious battle, and men yelled, and swords
Shocked upon swords and shields. A prince's banner
Wavered, then staggered backward, hemmed by foes.

A craven hung along the battle's edge,
And thought, "Had I a sword of keener steel—
That blue blade that the king's son bears—but this
Blunt thing!"—he snapped and flung it from his hand,
And lowering crept away, and left the field.

Then came the king's son, wounded, sore, bestead,
And weaponless, and saw the broken sword,
Hilt buried in the dry and trodden sand,
And ran and snatched it, and, with battle shout
Lifted afresh, he hewed the enemy down,
And saved a great cause that heroic day.

THE DISCOVERER

Edmund Clarence Stedman was a very distinguished American poet, who died at the beginning of 1908, in his seventy-fifth year. His writings are better known in America than they are in England, but the charm of his verse ought to make it widely read wherever the English tongue is spoken. In the following poem we have this fine writer in a tender mood, for the discoverer of whom he sings is just any little child that dies and all too soon sets out on the great mysterious journey to the unknown land. "The Discoverer" is really, in a sense, another view of "Peter Pan."

I HAVE a little kinsman
Whose earthly summers are but three,
And yet a voyager is he
Greater than Drake or Frobisher,
Than all their peers together!
He is a brave discoverer,
And, far beyond the tether
Of them who seek the frozen Pole,
Has sailed where the noiseless surges roll.
Ay, he has travelled whither
A winged pilot steered his bark
Through the portals of the dark,
Past hoary Mimir's well and tree,
Across the unknown sea.

Suddenly, in his fair young hour,
Came one who bore a flower,
And laid it in his dimpled hand
With this command:
"Henceforth thou art a rover!
Thou must make a voyage far,
Sail beneath the evening star,
And will a wondrous land discover."
With his sweet smile innocent
Our little kinsman went.

Since that time no word
From the absent has been heard.
Who can tell
How he fares, or answer well
What the little one has found
Since he left us, outward bound?
Would that he might return!
Then should we learn
From the pricking of his chart
How the skyey roadways part.
Hush! does not the baby this way bring,
To lay beside this severed curl,
Some starry offering
Of chrysolite or pearl?

Ah, no! not so!
We may follow on his track,
But he comes not back.
And yet I dare aver
He is a brave discoverer
Of climes his elders do not know.
He has more learning than appears
On the scroll of twice three thousand years,
More than in the groves is taught,
Or from furthest Indies brought;
He knows, perchance, how spirits fare,
What shapes the angels wear,
What is their guise and speech
In those lands beyond our reach,
And his eyes behold
Things that shall never, never be to mortal hearers told.

THE FLIGHT OF THE ARROW*

Richard Henry Stoddard was a notable American poet, born in 1825, who died in 1903. His poems are not so well known in other countries as those of other Americans, such as Longfellow, Whittier, and Lowell; but, for all that, he was a writer of distinction, and we are glad to include these lines of his, in which, following the example of Longfellow in his poem beginning "I shot an Arrow in the Air," he makes use of the arrow's flight to illustrate a great lesson in life.

THE life of man
Is an arrow's flight,
Out of darkness
Into light,
And out of light
Into darkness again;
Perhaps to pleasure,
Perhaps to pain!

There must be Something,
Above, or below;
Somewhere unseen
A mighty Bow,
A Hand that tires not,
A sleepless Eye
That sees the arrows
Fly, and fly;
One who knows
Why we live—and die.

THE LORD'S PRAYER IN VERSE

The author of this versified Lord's Prayer is not known, and he was probably not much of a poet, nor can we say that the beautiful words of the Scripture are improved by being turned into rhyme. We give the lines here, as young readers find verse easier to memorise than prose.

FATHER in heaven, hallowed be Thy name,
Thy kingdom come; Thy will be done the same
In earth and heaven. Give us daily bread;
Forgive our sins as others we forgive.
Into temptation let us not be led,
Deliver us from evil while we live.
For kingdom, power, and glory must remain
For ever and for ever Thine: Amen.

*From poems of Richard Henry Stoddard, copyright, 1880, by Charles Scribner's Sons.

JESU! LOVER OF MY SOUL

There is no finer hymn in the English language than this beautiful composition by Charles Wesley, the brother of John Wesley, who founded the Methodist Church. Charles Wesley was born in 1707 and died in 1788, his life being full of religious activity and earnest spreading of the Gospel. In all he composed some six thousand hymns, only a few of which are still in use, but "Jesu! Lover of My Soul" is certainly unsurpassed in all the range of sacred song. It is said that the author was sitting one day at his desk when a bird, pursued by a hawk, flew in at the open window. The hawk, afraid to follow, flew away, and Wesley, struck by the incident, was at once inspired to write this song, applying what he had just witnessed to our spiritual life.

JESU! Lover of my soul,
  Let me to Thy bosom fly;
While the nearer waters roll,
  While the tempest still is high.
Hide me, O my Saviour, hide,
  Till the storm of life is past;
Safe into the haven guide,
  O receive my soul at last!

Other refuge have I none;
  Hangs my helpless soul on Thee;
Leave, ah! leave me not alone,
  Still support and comfort me!
All my trust on Thee is stayed,
  All my help from Thee I bring;
Cover my defenceless head
  With the shadow of Thy wing.

Wilt Thou not regard my call?
  Wilt Thou not accept my prayer?
Lo! I sink, I faint, I fall,
  Lo! on Thee I cast my care.
Reach me out Thy gracious hand!
  While I of Thy strength receive;
Hoping against hope I stand,
  Dying, and behold I live!

Thou, O Christ, art all I want,
  More than all in Thee I find;
Raise the fallen, cheer the faint,
  Heal the sick, and lead the blind.
Just and holy is Thy name,
  I am all unrighteousness;
False and full of sin I am,
  Thou art full of truth and grace.

Plenteous grace with Thee is found,
  Grace to cover all my sin;
Let the healing streams abound,
  Make and keep me pure within.
Thou of life the Fountain art,
  Freely let me take of Thee;
Spring Thou up within my heart,
  Rise, to all eternity!

A STANZA ON FREEDOM

James Russell Lowell, a well-known American poet, was always a sturdy singer in the cause of freedom. In these lines he admirably expresses the ideal of freedom, for it is better "to be in the right with two or three" and suffer in consequence than to be comfortably in the wrong with the many and thus escape "the troubles that afflict the just."

THEY are slaves who fear to speak
  For the fallen and the weak;
They are slaves who will not choose
Hatred, scoffing, and abuse,

Rather than in silence shrink
From the truth they needs must think;
They are slaves who dare not be
In the right with two or three.

THE GOOD, GREAT MAN

Here is a short poem which may be described as a gem in every sense. The noble and inspiring thought which it contains is expressed in language of simple beauty and dignity. The lesson it teaches us is one easy to understand if difficult to put in practice! For the more we know of life the more sure shall we become that the poet is right in thinking "goodness and greatness are not means, but ends." There is a familiar saying: "virtue is its own reward." This means that to do the right thing, not for the sake of recompense or recognition, but merely for the sake of doing the right thing, is the greatest reward that virtue can obtain. That is the lesson of this fine little poem by Coleridge, the author of "The Ancient Mariner."

HOW seldom, friend, a good, great man inherits
  Honour and wealth, with all his worth and pains!
It seems a story from the world of spirits
When any man obtains that which he merits,
  Or any merits that which he obtains.

For shame, my friend, renounce this idle strain.
  What wouldst thou have a good, great man obtain?
Wealth, title, dignity, a golden chain,
Or heap of corses which his sword hath slain?
  Goodness and greatness are not means, but ends.

Hath he not always treasures, always friends,
  The great, good man? Three treasures: love, and light,
And calm thoughts, equable as infant's breath;
And three fast friends, more sure than day or night:
  Himself, his Maker, and the angel Death.

LORD, IT BELONGS NOT TO MY CARE

Richard Baxter was an English Presbyterian minister who had a long, eventful life between the years 1615 and 1691, being sometimes eminent in the religious affairs of his country, but in the later years of his life often subject to persecution. He wrote much both in prose and verse. The following is a good example of his religious poetry.

LORD, it belongs not to my care,
  Whether I die or live;
To love and serve Thee is my share,
  And this Thy grace must give.

If life be long I will be glad,
  That I may long obey;
If short—yet why should I be sad
  To soar to endless day?

Christ leads me through no darker rooms
  Than He went through before;
He that into God's kingdom comes,
  Must enter by His door.

Come, Lord, when grace hath made me meet
  Thy blessed face to see;
For if Thy work on earth be sweet,
  What will Thy glory be?

Then I shall end my sad complaints
  And weary sinful days;
And join with the triumphant saints
  To sing Jehovah's praise.

My knowledge of that life is small,
  The eye of faith is dim;
But 'tis enough that Christ knows all,
  And I shall be with Him.

LITTLE VERSES FOR VERY LITTLE PEOPLE

You are going out to tea to-day,
So mind how you behave;
Let all accounts I have of you
Be pleasant ones, I crave.

Don't spill your tea, or gnaw your bread,
And don't tease one another;
And Tommy mustn't talk too much,
Or quarrel with his brother.

Say "If you please," and "Thank you, Nurse."
Come home at eight o'clock;
And, Fanny, pray be careful that
You do not tear your frock.

Now, mind your manners, children five,
Attend to what I say;
And then, perhaps, I'll let you go
Again another day.

Lucy Locket
Lost her pocket,
Kitty Fisher
Found it;
Nothing in it,
Nothing in it,
Just the binding
Round it.

The Rose is red,
The Violet's blue;
Pinks are sweet,
And so are you!

Diddle, diddle dumpling, my son John,
He went to bed with his stocking on;
One shoe off, and one shoe on,
Diddle, diddle dumpling, my son John.

Ring the bells—ring!
Hip, hurrah for the King!
The dunce fell into the pool, oh!
The dunce was going to school, oh!
The groom and the cook
Fished him out with a hook,
And he piped his eye like a fool, oh!

On Christmas Eve I turned the spit,
I burnt my fingers, I feel it yet;
The cock sparrow flew over the table,
The pot began to play with the ladle;
The ladle stood up like an angry man,
And vowed he'd fight the frying-pan;

The frying-pan behind the door
Said he never saw the like before;
And the kitchen clock I was going to wind
Said he never saw the like behind.

Great A, little A,
This is pancake day;
Toss the ball high,
Throw the ball low,
Those that come after
May sing heigh-ho!

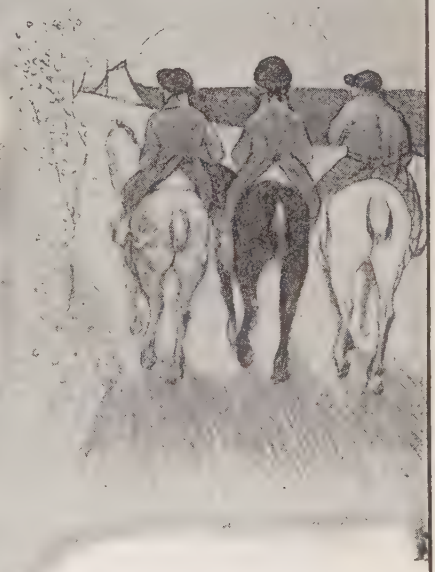
Jack Jingle went 'prentice
To make a horse-shoe,
He wasted the iron
Till it would not do.
His master came in,
And began for to rail;
Says Jack: "The shoe's spoiled,
But 'twill still make a nail."

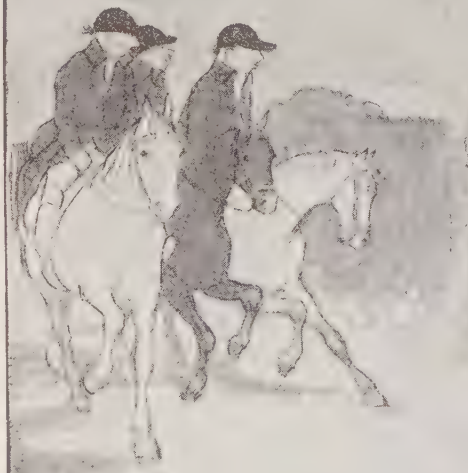
He tried at the nail,
But, chancing to miss,
Says: "If it won't make a nail,
It shall yet make a hiss."
Then into the water
Threw the hot iron, smack!
"Hiss!" quoth the iron;
"I thought so," says Jack.

THERE were three jolly Welshmen,
As I have heard say,
And they went a-hunting
Upon St. David's Day.

All the day they hunted,
And nothing could they find;
But a ship a-sailing,
A-sailing with the wind.

One said it was a ship,
The other he said "Nay";
The third he said it was a house
With the chimney blown away.





And all the night they hunted,
And nothing could they find
But the moon a-gliding,
A-gliding with the wind.

One said it was the moon,
The other he said "Nay";
The third he said it was a cheese
With half o' it cut away.

Je suis un petit poupon
De belle figure,
Qui aime bien les bonbons
Et les confitures.
Si vous voulez m'en donner
Je saurai bien les manger —
La bonne aventure ! Oh, gai !
La bonne aventure !

Lorsque les petits garçons
Sont gentils et sages,
On leur donne des bonbons,
De jolies images.
Mais quand ils se font gronder,
C'est le fouet qu'il faut donner—
La triste aventure ! Oh, gai !
La triste aventure !

Je serai sage et bien bon,
Pour plaire à ma mère ;
Je saurai bien ma leçon,
Pour plaire à mon père.
Je veux bien les contenter,
Et s'ils veulent m'embrasser—
La bonne aventure ! Oh, gai !
La bonne aventure.

I'm a chubby little thing,
Rather pretty too.
I *often* eat the sweets folks bring,
And jam I *always* do.
Just give me some, and I will show
The way to eat them up I know.
'Tis awful fun. Oh, joy !
'Tis awful fun.

'Tis very nice when little boys
Do just what boys should do ;
Folks give them sweets and often toys,
And pretty pictures too.
But when they're naughty, I believe,
A whipping then is what folks give.
'Tis awful sad. Oh, joy !
'Tis awful sad.

I will be very, very good,
To please my dear Mamma,
And learn my lessons, as I should,
To please my dear Papa.
I always want to do what's right
When Mummy cuddles me up tight.
'Tis awful fun. Oh, joy !
'Tis awful fun.

Ah ! vous dirai-je, Maman,
Ce qui cause mon tourment !
Papa veut que je raisonne
Comme une grande personne ;
Moi je dis que les bonbons
Valent mieux que la raison.

Darling Mother, shall I say,
Why I feel so sad to-day ?
Daddy thinks I ought to know
As much as quite a *big* fellow !
I think games, with sweets for prize,
Better far than being wise.

Pan ! Qu'est-ce qu'est là ?
C'est Polichinelle,
Mam'selle.
Pan ! Qu'est-ce qu'est là ?
C'est Polichinelle, que voilà !

Toujours joyeux,
Il aime fort la danse,
Il se balance,
D'un petit air gracieux ;
Pan ! Qu'est-ce qu'est là ?
C'est Polichinelle, que voilà !

Il est mal fait
Et craint de vous déplaire
Mais il espère
Vous chanter son couplet ;
Pan ! Qu'est-ce qu'est là ?
C'est Polichinelle, que voilà !

A vous faire rire,
Mes enfants, il aspire
Jeunes et vieux
Ceux qui rient sont heureux ;
Pan ! Qu'est-ce qu'est là ?
C'est Polichinelle, que voilà !

Halt ! Who goes there ?
Punchinello,
My fine fellow !
Halt ! Who goes there ?
Punchinello ! Right here !

Always debonnair,
He is fond of a dance,
To retire and advance,
With a courtly air.
Halt ! Who goes there ?
Punchinello ! Right here !

He fears he is wrong ;
But yet, in despite,
He'll sing you a song,
If you will invite.
Halt ! Who goes there ?
Punchinello ! Right here !

To cure all who mope,
My friends, is his hope.
Laugh, Age and Youth,
And be happy in truth.
Halt ! Who goes there ?
Punchinello ! Right here !

Optic Nerve from the Brain
Eyeball
Blind Spot
Fibres of Optic Nerve spreading over Retina
Yellow Spot of direct vision
Outer Wall of the Eyeball
Layer of Pigment Cells
Layer of Rods & Cones
Layer of Nerve Cells
Blind Spot
Yellow Spot
Outer Wall of the Eyeball
Rods
Cones
Outer layer of Granules & fine Nerves
Fine Nerves interwoven
Inner layer of Granules & fine Nerves
Fine Nerves interwoven & continued to the Nerve Cells
Fine fibres of the Optic Nerve

In the first picture we see a section of the eyeball between the blind spot and the optic nerve. The middle picture shows the interior of the eyeball, with the nerve-fibres radiating from the blind spot. In the right-hand picture a portion of the retina is highly magnified, showing the various layers and the rods and cones.

THE LIGHT IN OUR EYES

CONTINUED FROM 4298

We know all about the lens of the eye, and now we must trace the light after it has passed through the lens, and note what next happens to it. As the pictures on page 4293 show, there is still the greater part of the eyeball for the light to pass through, whether the eyeball be long or short. This part of the eye is entirely filled with a sort of jelly, made of a large number of thin sheets. The name for it means that it is like a piece of glass, while the stuff that fills the front part of the eye, between the cornea and the iris, is quite watery.

At the back of this part of the eye, where the glassy material lies, is the retina, the sensitive plate or curtain where we find the all-important nerve-cells. Before we study it, we must just observe what has happened to the light in the course of its passage through four different things—the cornea, the watery fluid behind it, the lens, and the jelly-like material behind the lens.

In the first place, we must note that in health all these materials are practically transparent, although they cannot be quite transparent, and we know that they throw back a certain amount of light, because when we look at anyone's eye we can see a little picture reflected from the surface of it, showing that all the light which reaches it does not go through. More important than this slight loss of light is the fact that, as we sometimes notice, there are dark patches or spots in our field of vision, and we say that we have "spots before our eyes." These spots are of two kinds—those which are always there and in the same place, and those which are just seen for a time and then disappear. Permanent spots before the eyes are due to some fault in the cornea or in the lens.

There has been some little injury done to the cornea, or some cause of disturbance has occurred in the lens; and in the course of recovery there has been made what is called scar-tissue. Nothing can be done to remove these spots, but, fortunately, people usually get to take no notice of them.

The other kind of spots before the eyes come and go. As a rule we notice them only when we are not very well. They are most commonly seen in the morning by people who have gone to bed too late at night, especially if they have eaten or drunk more than is good for them. With time and a little careful living, and especially a dose of medicine to clear the blood, these spots disappear. The cause of them is extremely interesting. What produces the spots is to be found there in the eye, perhaps

little kinks in the folds of the jelly-like material, perhaps a few white blood-cells that are wandering about on some business of their own, and get in the way of the light, just as a person's head may get in the way at a magic-lantern show and cause a shadow.

THE HEALTHY EYE SHOULD NOT NOTICE LITTLE THINGS THAT IRRITATE

The healthy eye does not notice these things; it is sensitive, but it is not too sensitive. When, however, any part of the body, and especially such a thing as the eye or the ear, is not quite well, or when the body, as a whole, is rather out of form, then these sensitive places become too sensitive; they become irritable, and this is known as the irritability of weakness. It is true not only of a weak eye or a weak ear or of a weak body in general, but it is also true of a weak mind, of weak judgment and weak feelings. If it continues, the results are apt to be very harmful indeed.

The eye in health ought to ignore trifles of no importance inside itself, and it ought to be able to stand a fair amount of light without injury. The healthy ear ought to ignore little disturbances going on inside itself due to the circulation of the blood, movement of the bones and muscles in the middle ear, and so on; it ought to hear no sounds from these causes.

But the eye or the ear that has been overstrained, and has become weak, is bothered by seeing spots or by hearing a singing in the ears, and the case may get much worse, because, in the case of the eye, there are very likely horrid dreams in which unpleasant things are seen, or if it is especially the ear that has been overstrained, there are dreams in which horrid things are heard.

WHY PEOPLE SOMETIMES SEE AND HEAR THINGS THAT ARE NOT THERE

Sometimes the thing goes from bad to worse, and people begin seeing and hearing, apart from dreams, things that are not there. Everyone should know a little about this subject, because, like almost all the evils in the world, these are easy to withstand in their beginnings, but very hard to catch up with if they get a good start. We have to remember that, for us human beings, the eye and the ear are the most highly developed, the most important, the most constantly used, and therefore the most delicate of our organs of sense, and we ought always to be attentive when they begin to misbehave themselves. It is not their fault, but ours, as a rule. A little care, common-sense, and rest at this stage will put everything right.

Now, having seen how it is that the light may be interfered with on its way to the retina, we must just observe what these various materials do to the light in the way of bending it. The diagrams on page 4293 show what happens to the light, and we have only to glance at them to see how closely the eye resembles the various kinds of instruments with lenses that human beings make and use for themselves.

If we look at the course of the light in the normal eye, the short-sighted eye, and the long-sighted eye, we shall be ready to understand how spectacles affect the refraction of the light as it passes through the four materials on its way from the outside to the retina.

HOW THE RAYS OF LIGHT ARE BENT INSIDE THE EYE

All we need to do is to remember the simple rule that, when light passes through a lens, the rays are bent towards the thicker part of the lens, wherever that is. This, of course, is equally true whether the lens be inside the eye and made by the body, or whether it be a lens of glass placed directly in front of the eye.

If we look at the pictures on page 4293, we can easily find out for ourselves what kind of lens it is that would be useful for a short-sighted and what for a long-sighted person; also what kind of glasses would be required for a person whose own lenses had been taken away on account of cataract.

The way really to understand this subject—and the same is true of many subjects—is not merely to read about it or to look at pictures. It is always necessary to do something more actively oneself. We should either explain the thing to someone else, by word of mouth, or we should write down for ourselves an account of the facts, and in both cases we ought to make diagrams for ourselves as we go along.

In this way we soon discover what parts of the thing we really understand, and what parts we do not, and very

often, if we try, we can think a thing out for ourselves. To do that once is better than to read the explanation of it many times. Therefore, when this part of the subject has been read, let us take a piece of paper and a pencil, and draw for ourselves various kinds of eyes, showing the course of the rays of light in each case; then add the various kinds of lenses, and note how they will affect things; and, finally, we may draw pictures of what would happen if the glasses that we ordered were too strong, either in one direction or the other. When we have gone through all this, we may believe that we have done justice to the subject.

Everything about the eye that we have studied hitherto, from the eyelashes onwards, exists in order to serve the retina. This is one of the most wonderful things in the whole body. We are to think of it as part of the eye, but we must also—if we are really to understand it—think of it as part of the brain. We remember that it actually grew out from the brain, and, when we come to look at it, we find that it is indeed an immensely complicated structure made up chiefly of delicate nerve-fibres and nerve-cells.

A PART OF THE EYE THAT IS REALLY A PART OF THE BRAIN

There is also in it, as in every other part of the body, a certain amount of supporting tissue, the business of which is just to hold the rest together. Now, it is very interesting to discover that this supporting tissue of the retina is made of a special kind of cell which we find inside the brain itself, forming the supporting tissue there.

This alone would be a proof of what we know on many other grounds, that the retina of the eye of backboned animals is an outgrowth from the brain.

The various parts of the retina are usually described as being arranged in ten layers, but it is not necessary for us to study them all. Some of these layers consist of cells and others of nerve-fibres. It is the ninth layer from the front that we must carefully look at, because here we find the cells which are most deeply concerned with seeing. We might expect these cells to be in the very front of the retina, immediately behind the glassy jelly of the eyeball, but, in point of fact, they are not, and the light has to pass through no fewer than eight layers of various structure before it finally reaches the true vision-cells.

We must understand that these layers are extremely thin and delicate, and are only to be made out under a microscope of very high power. So what happens is not as impossible as it might sound, if we thought that these various layers were thick things and liable to disturb the light-rays. They do not do so to any degree that matters.

HOW PART OF THE BRAIN GROWS OUT AND FORMS THE RETINA

The inside of the brain is hollow and lined with cells. The brain part of the eye is formed by a hollow outgrowth from the brain, and that outgrowth gets indented to form the retina. The vision-cells are not on the front of the retina, but close to the back of it. They are really the same as the cells that line the cavity of the brain, and when the brain sends out its little bulb on the way to make the eye, these cells line that bulb, which we can see on page 4401.

The vision-cells are of two kinds, called rods and cones from their shape. They form altogether a regular palisade of cells upon which the light strikes, and if the refracting materials in front are just right, then the light is sharply focussed just where it reaches the retina. There are far more rods than cones in the eye, but there can be no doubt that the cones are more important, as we shall see.

In every retina there are two spots which differ from the rest of it. One is the place where the great optic nerve spreads out, so to speak, to form the retina. At that point there are no rods or cones, and so it is blind. Light falling on that point is not seen.

THE SPOT IN THE EYE THAT IS BLIND AND THE SPOT THAT SEES BEST

Close beside this blind spot is another which is called the yellow spot, and as the one spot is blind, so the other is the part of the retina where all the best seeing is really done. It is packed with cones and nothing else. That is why we say that the cones are more important than the rods. This spot is called yellow because there is a certain amount of yellow material

lying in the supporting tissue between the cells there. We do not as yet quite know the reason why it is there.

On careful study of the yellow spot, we notice that every kind of arrangement has been made in order to promote good seeing there. The eight layers that lie in front of the cones—we have seen they lie in front of the vision-cells everywhere in the retina—are at their very thinnest in this particular place. Some of them, indeed, are practically not to be found. Also, there are no large blood-vessels to get in the way of the light, but only extremely small capillaries.

All our best seeing is done by means of this spot. Whenever we wish to see a thing precisely, we turn our eyes so that the light from it shall fall upon the yellow spot, and the great business of the muscles that move the eyeballs is to move them together in such a way that the light of any particular thing that we want to see shall exactly fall on the two yellow spots, the one to be found in each eye.

THE WONDERFUL LITTLE CONES THAT HELP US TO SEE COLOURS

Quite lately a great deal of interesting work has been done in studying the retina, and especially the region of the yellow spot, in various kinds of animals. Not enough has yet been done for us to go much into detail about it, but it seems quite clear that the cones are more wonderful than the rods, and can do more.

The cones appear much later than the rods in the age-long history of the progress of backboned animals, and it seems especially that the gathering together of cones into one place, without any rods at all, so as to form a yellow spot, only occurs in the highest kinds of backboned animals—namely, the birds and the mammals. There is also good reason to believe that throughout the whole retina, but especially in the neighbourhood of the yellow spot, there has been a gradual evolution in the matter of seeing colours, and it is these wonderful cones that are responsible for this.

It seems to have been proved that if two things are to be seen as two, the light from them must fall upon two cones in the retina. If the two things are so small, or if they are so far away and so close to each other that the light from them only falls on one cone in the retina, they are seen as only one thing. This is the case with the double stars which are so extremely common in the sky ; so much so, indeed, that every advance in the structure of the telescope shows us that more and more stars, which we had thought to be single, are really double.

WHY WE SEE BEST WHERE THE CONES OF THE EYE ARE TIGHTLY PACKED

When the eye is unaided, the light from the two stars falls only on one cone, and so to us it is only one star. Every time an astronomer resolves a star, as it is said, into two, what happens is that the telescope has spread the light out sufficiently for it to strike two cones in the retina. Evidently the fineness of vision will depend on the nearness of the cones to each other, and that means that it is greatly to our advantage to see with the part of the eye where the cones are tightly packed up against one another without any rods or anything else separating them. That, of course, is what the yellow spot does for those of the higher animals in which it has been developed.

Careful study of these facts makes it certain that for every cone in the retina there must be a special path in the optic nerve, and at least one special cell—perhaps a thousand—in the vision centre of the brain. We have used the phrase "the region of the yellow spot," because around the spot itself, where there is nothing but cones, there is an area of the retina with a good proportion of cones, but towards the edge of the retina there are scarcely any cones at all, and it is practically made up of rods.

THE LITTLE RODS OF THE EYE THAT HELP US TO SEE IN A DIM LIGHT

It has quite lately been shown that the rods have the business of helping us to see in dim light, which the cones do not notice. Ordinary daylight is so bright that the rods are exhausted by it and made useless ; therefore in such light we see by the cones only. But the case is different if the rods are shielded from bright light for a little. When this happens they get time to remake the chemical substances which are necessary for their work, and then they can act.

Let us see how this works out. When we go into a dimly-lit room, or when we go out of doors from a brightly-lit room, upon a moonless but starlit night, we know that, at first, we see practically nothing, and then afterwards we begin to see. Until quite lately it was supposed that the reason of this was simply that we have to wait for the pupil to expand in the dimmer light so that more light may enter the eye. That is true, but we now know that it is less than half the truth.

WHY WE CANNOT SEE WHEN WE GO SUDDENLY OUT OF A BRILLIANT LIGHT

The principal reason why we cannot see at first in such cases is that the rods of the retina are exhausted by the bright light to which they have been exposed, and the cones cannot see in a dim light. But after a few minutes the rods regain their power, as the blood is always flowing rapidly through the retina, rich in materials from which the rods can make the special substances upon which light acts when we see. So, after a little while, we begin to see again, but we see no colours. The rods are unable to distinguish one colour from another; if they see at all, they see a sort of bluish grey.

Now, suppose we have gone out of doors on a starlit night, and suppose we notice a star, not too bright a star. As long as we do not look straight at it, we shall see it, but directly we look straight at it, so as to see it as well as possible, it disappears. Before we go on any farther, let us try to think out the reason for ourselves.

The reason is that, as we have already learnt, when we look straight at anything we place our eyeballs so that the light shall fall directly upon the yellow spot. But there are no rods, only cones, at the yellow spot, and as the cones do not take any notice of very faint light, the star disappears.

THE DIFFERENT WAYS IN WHICH THE RODS AND THE CONES SEE LIGHT

Still more has been found out about the rods and cones within the last two or three years. Whatever kind of light falls on the rods, they see only the colour—if it can be called a colour—that we have described. This has a very interesting result if we spread out the light of the sun by means of a prism. Ordinarily, if it is nice and bright, we see a band of beautiful colours. It is the cones in our retina that enable us to do this. But if we make the band or spectrum very dim, the cones will be blind to it, and we can only see it by the rods. Its appearance now changes, because our power of seeing colour has gone, and all we see is a band of dim grey light, a little shortened at the red end—or, rather, the end which was red when it was brighter and the cones could see the colour. The reason why the band seems shortened is that the red rays of the spectrum do not affect the rods at all, while all the other rays produce the dim grey light we have already mentioned.

These discoveries teach us how valuable and important the cones are, and what a great advance in the history of vision it was when the cones first appeared, and especially when they were gathered together to form the yellow spot. We have said that the rods and cones form the ninth layer of the retina. Still deeper is the tenth and last layer of the retina, composed of cells which are filled with a dark brown material.

HOW THE PIGMENT-CELLS GIVE POWER TO THE RODS AND CONES

These pigment-cells, as they are called, seem to be very important and useful. For one thing, under the influence of light we find that the pigment seems to run into the ninth layer, so as to form a little dark sheath around each rod and cone. This may be very important in enabling each of the vision-cells to act without getting muddled with the others.

Further, the pigment in the pigment-cells makes a great store of material, on which the vision-cells themselves can draw. Unless these vision-cells, the rods and cones, are properly supplied with the materials they need, and unless that supply is steadily kept up, they lose their power.

In another part of this book we have read that we can blind the eye by merely pressing on the eyeball for two or three seconds, because in doing so we retard the flow of blood—that is to say, the flow of new food materials through the retina. The coloured matter inside the vision-cells is bleached by light, and when the cells are bleached they cannot see; so

we know that the fresh supply must be continually kept up. If we knew more about the eight front layers of the retina, we should very probably find that they are as interesting and important as the deepest two layers, about which we have learnt a little. But we must wait for more knowledge about them.

A LAW ABOUT THE EYE THAT IS TRUE OF ALL OUR SENSES

It is a law about the action of the retina, and it is also true of the other senses, that what we feel is not in simple proportion to the intensity or strength of what excites us. We might suppose, if we did not know, that what would happen is this: add so much to the brightness of the light, and we should feel accordingly; do it again and again and again, and the result will always correspond.

But that is not the case, as we all know when we come to think of it. Add one candle to one candle, and we know the difference; add one to ten, and we scarcely know the difference; add one to fifty, and no one would notice the difference; add one voice to four voices, and we all know the difference; add one to forty, and no one could tell. In other words, the greater the outside power that excites our senses, the greater is the amount that we must add to it in order that we shall know the difference.

If this were the right place for it, it might be shown that this law is true of all our lives, and is most important every day. It means that the higher the pitch of our talking or of our writing, of our newspapers or of our feelings, the more difficult is it to increase the impression made by them. The man who is always speaking in a loud, shouting voice must shout very much louder if he is to excite our attention; but the person who always speaks in a low, soft, gentle voice has only to raise it the least little bit, and we at once give him all attention.

DO WE STOP SEEING AS SOON AS THE LIGHT GOES?

This law is true of all sensations and feelings, and of all our responses; it is probably true of every kind of living matter, and its discovery was one of the great feats of the nineteenth century. We mention it here because it can be very beautifully studied in the case of the retina, and everyone will agree how interesting it is to find that what we prove for the retina is true of all life. The question of time is very important in regard to the action of the retina. Do we see directly the light strikes us? Do we stop seeing directly the light ceases? The answer is No to both these questions, as it is in all cases of sensation.

It takes a little time for the light to act before we see. During that time we have little doubt that the light is decomposing the special chemical substances which are lying ready for it in the vision-cells, and it is the changes produced by their decomposition that excite the fibres of the nerve of vision, and send a message to the brain.

It is probable that people vary within rather wide limits in regard to the period between the striking of the light and the sensation of its presence. We notice a similar thing in other cases, and not only in cases of sensation, for we find that there is always a period, perhaps about the hundredth of a second, between the moment at which a nerve says to a muscle "Contract" and the moment at which the muscle obeys. In this case, also, we suppose that chemical changes are going on in the muscle-cell which require a little time.

HOW THE CONES SEE THE LIGHT BEFORE THE RODS SEE IT

Quite lately it has been also proved that the different parts of the retina are not the same in this respect. The cones, in every respect of a higher type than the rods—even though they are less sensitive in dim light—are affected by light more quickly than the rods are, and it is possible to prove, by experiment carefully made, that first of all we see by the cones only, and then by the rods, too. This makes a difference to what we see, because when the rods come into action they contribute a sort of uniform grey light to everything equally; whereas, during the moment before that, we were seeing by the cones only, and they, of course, see colours.

Lastly, we find that the retina goes on seeing for a little while after the light has ceased. The duration of this after-sensation varies. If the light is moderate, probably the average length of the after-sensation is about one-fortieth of a second, but sometimes a little longer.

The next part of this is on page 4507.

THE COUNT OF MONTE CRISTO

PART 2

CONTINUED FROM 4332

IT was not long after Edmond's escape from the Château d'If that the means by which it had been effected were discovered. But as there was no doubt about the sack containing the supposed dead body having been thrown into the sea, it was supposed that the prisoner had only exchanged the living death of his cell for the more merciful death by drowning. Edmond Dantès was "officially dead."

Some two years later the keeper of the Pont du Gard inn, not far from the town of Beaucaire, was, as usual, lounging listlessly at his door, for trade was bad and he had but little custom. when a traveller on horseback dismounted at his door and entered. The stranger proved to be a clergyman of grave and reverend aspect, and the innkeeper made rather a fuss in attending upon him. The visitor, who gave the name of the Abbé Busoni, and whose dark and penetrating eyes seemed to search into the inmost mind of the innkeeper, had speedily banished the listlessness of that person, and made him all excitement by recalling the events of sixteen years before.

The name of the innkeeper was Gaspar Caderousse, which fact the abbé knew, and he astonished Caderousse by showing a minute knowledge of his earlier history. Of Edmond Dantès the innkeeper spoke with much warmth of feeling, and swore that he had ever deeply and sincerely lamented the unhappy fate of that poor young man. The abbé explained that he had been present at the death of Dantès in prison, and said that even in his dying moments the prisoner had protested he was utterly ignorant of the cause of his imprisonment.

"And so he was!" exclaimed Caderousse. "How should he have been otherwise? Ah, Monsieur l'Abbé, the poor fellow told you the truth."

"It was for that reason, then, that he besought me to clear his memory from any stain that might have fallen upon it," said the Abbé Busoni, who went on to tell, to the growing excitement of Caderousse, how a fellow-prisoner of Dantès, on being liberated, had given to Edmond a diamond of great value, with which he might have bribed the gaoler; but Edmond had not attempted to do so, and had in turn given it to the abbé, with instructions to sell it at Marseilles and to divide the money equally between five persons—the only five persons who had loved poor Dantès. These were Mercédès, Danglars, Fernand, Caderousse, and Edmond's aged father. The abbé had heard of the death of old Dantès, and now he was told the old man had died of starvation.

The innkeeper was now excited beyond measure, and recounted all he knew of the persons and events connected with Edmond Dantès, although his wife had intervened and chided him for telling a stranger so much of private affairs. All that the intelligence of the poor Abbé Faria had been able to guess at from Edmond's own story was confirmed and made plain by the statements of Caderousse, who proved to his visitor that Danglars and Fernand had been the deadly enemies of Edmond.

How all the enemies of Edmond Dantes had prospered

But whereas Danglars had prospered and was now rolling in wealth, and Fernand also had risen to great things, being now the Count of Morcerf, Monsieur Morrel, who had been a real friend to Edmond, and ever an honest man, was in dire extremities, his great shipping business having met with a series of misfortunes.

The wicked had flourished, and the honest had suffered. Danglars' fortune had been built up by fraud. Fernand, now a distinguished soldier, had made his success when, as a French soldier in the service of the Greeks, he betrayed the Albanian patriot, Ali Pasha, to the Turks, thus getting a traitor's reward from the enemy, as well as stealing the fortune of his victim. The Countess of Morcerf was the Mercédès who was to have married Edmond, and who had, indeed, truly mourned her lost lover until all hope was past.

"And M. de Villefort?" asked the abbé. "Do you not know what became of him, and the share he had in Edmond's misfortunes?"

"No; I only know that, some time after having arrested him, he married Mademoiselle de Saint-Méran, and soon after left Marseilles; no doubt but he has been as lucky as the rest; no doubt he is as rich as Danglars, as high in station as Fernand. I only have remained poor, wretched, and forgotten."

The diamond for which Caderousse became a murderer

"You are mistaken, my friend," replied the abbé. "God may seem sometimes to forget for a time, while His justice reposes, but there always comes a moment when He remembers—and behold a proof!" As he spoke, the abbé took the diamond from his pocket, and, giving it to Caderousse, said: "Here, my friend, take this diamond; it is yours."

"What! for me only?" cried Caderousse. "Ah, sir, do not jest with me!"

"This diamond was to have been shared among his friends. Edmond had one friend only, and thus it cannot be divided. Take the diamond, then, and sell it; it is worth two thousand pounds."

But, alas! this good fortune was the undoing of Caderousse, who was a man of weak and undecided character, and was worthy to be called neither a friend nor an enemy of Dantès. He and his wife, greatly agitated over their new possession, invited a diamond dealer to the lonely Pont du Gard inn to examine and purchase the diamond which the mysterious abbé had given them. The lowest instincts of both husband and wife were inflamed, not only by the sight of the precious stone, but by the thought that they might keep the gem and steal the money from the dealer who had come to buy it. Thus it was that Caderousse became a murderer, and was condemned to the galleys at Toulon.

The strange Count of Monte Cristo comes to Paris

The years passed by, and still all the wicked people concerned in our story seemed to prosper. It would be about eight years after the tragedy at Caderousse's inn that a certain Count of Monte Cristo had become a great figure in the life of Paris. His name awakened thoughts of romance and dazzling wealth in the minds of all, as he was the hero of a hundred strange stories, more suggestive of the time of the "Arabian Nights" than of the first half of the nineteenth century. It was Albert, the son of the Count of Morcerf, who first introduced the Count of Monte Cristo to the high society of Paris. They had become acquainted at Rome, where Monte Cristo had been able to render a great service to the Viscount Albert of Morcerf, and his friend, the Baron Franz d'Epinay.

This Monte Cristo was a tall man, with a lithe, agile figure, capable of the greatest exertion. While his face was pale to ghastliness, his eyes were large, and gleamed at times with an uncanny light. His hair was black as jet, making the deadly paleness of his countenance the more pronounced.

Baron Franz was convinced that he had met this strange man before. He had landed on one occasion on the island of Monte Cristo, and there he had encountered a band of smugglers, whose chief invited him to dinner. After he had been blindfolded, he was led into a cave, which was fitted up with the most marvellous luxury; and there he was entertained to a wonderful banquet. This was concluded by his host inviting him to taste some greenish paste contained in a beautiful silver vessel. It was the

THE BARON HAD BEEN LED BLINDFOLDED INTO A CAVE OF MARVELLOUS LUXURY.

famous "hashish." After Baron Franz had tasted it, he sank into gorgeous dreams and visions, and when he awoke again, it was to find himself on the seashore. The most diligent searching never brought him again to the secret entrance of this magic cave.

All sorts of stories were afloat in Paris as to the history of this Count of Monte Cristo. When he went to the Opera, he was accompanied by a beautiful Greek girl, said to be a princess, named Haidée, whose guardian he was. A well-known lady declared he was a vampire! But the air of mystery about him was just what Paris liked, and the fact that he had unlimited credit at the bank controlled by the Baron Danglars was enough to make him talked about, and to open all doors to him.

There were others than the Baron Franz who thought they had met him before. When he was presented to the Countess of Morcerf, that lady showed such agitation in meeting him that her son was seriously alarmed. But nothing ruffled Monte Cristo. Calmness and deliberation marked all his movements; in some respects he was more like a machine than a human being. If he made an appointment for nine o'clock, he entered when the clock was striking the fifth of the nine hours. Everything he said he would do was done precisely. And now the schemes he had long studied in secret he had begun to carry through as certainly and relentlessly as Fate.

There was a house at Auteuil, a suburb of Paris, which was to be let. One day, with his steward, Bertuccio,

Monte Cristo drove out to see it, as he had arranged to purchase it.

"Tell them to stop at Rue de la Fontaine, No. 28," said the count, fixing his eyes on the steward, to whom he gave this order. Bertuccio's forehead showed great beads of perspiration when he heard the number of the street mentioned, but he gave the order.

THE STEWARD WHO BELIEVED HIMSELF TO BE A MURDERER

Bertuccio accompanied his master from room to room, showing great uneasiness when they went down a stair that led to the garden; for Monte Cristo seemed to know all that had happened in the house. When his master asked him if he supposed anything had been buried beneath a tree to which he had led the steward, Bertuccio had finally to confess all he knew, saying that the Abbé Busoni was the only one who already knew the story of his crime. Villefort had callously refused justice to Bertuccio many years before, and he had sworn to revenge himself upon him. He had traced him to this house, and in this garden he struck him down in the very instant when Villefort had been preparing to bury a little infant that was still alive. That child Bertuccio had reared, and given him the name of Benedetto; but he had grown to be a scoundrel of the worst type, and was now a criminal outcast.

After this confession, Bertuccio said his master could do with him as he wished, but Monte Cristo set his mind at rest by telling him he had not struck true—that Villefort still lived.

MONTE CRISTO LAYS A DEEP PLOT TO CONFOUND ONE OF HIS ENEMIES

There was a deep-laid scheme in the purchase of this house at Auteuil. The Count of Monte Cristo arranged a grand dinner-party there. Among those invited were the Baron and Baroness Danglars and M. de Villefort, who, as procureur du roi, or public prosecutor, had long enjoyed power.

The repast was magnificent; Monte Cristo had endeavoured completely to overturn the Parisian ideas, and to feed the curiosity as much as the appetite of his guests. It was a veritable fairy banquet, and not only impressed his guests with the enormous wealth of their host, but with his exhaustless ingenuity in producing surprises for them. After dinner Monte Cristo led the conversation on to the subject of the tragedies of old houses. If that house could but tell what had happened in it years ago, how interesting and terrible it might be! And so, step by step, he took his party from room to room and down the stairs into the garden, telling them the strange story of a child that had been buried there, which the gloomy old house seemed to have told to him. Certain of the guests were painfully excited by the count's rehearsal, as he had meant them to be, and M. de Villefort had to confess to himself that he was in the hands of Fate personified by this terrible and mysterious man known as the Count of Monte Cristo.

Villefort had a daughter by his first wife, for he had married a second time. Her name was Valentine, and at the command of her father, but not by her own wish, she was engaged to be married to the Baron Franz d'Epinay. This beautiful girl was in love with a gallant young military officer named Maximilian Morrel, son of the Marseilles shipowner. But neither of them had dared to avow their affection for each other to Valentine's father.

THE MAN WHO SIGNED HIMSELF "SINDBAD THE SAILOR"

It was Franz, however, who told Maximilian that among the stories of Monte Cristo it was said he often gave great gifts of money to help deserving people, and signed himself "Sindbad the Sailor." This was great news for Maximilian, as his father had been saved from ruin by a generous gift from an unknown benefactor who had signed himself as Sindbad the Sailor. He hastened at once to the house of Monte Cristo to thank him for his generosity, and from that day became a devoted admirer of the strange man. His inmost thoughts he told to him, and all the story of his hopeless love for Valentine.

Meanwhile the tide of fortune seemed to have turned with Baron Danglars. His business had suffered many losses, but his greatest loss of all was due to some false news about the price of stocks and shares which had been telegraphed to Paris by means which Monte Cristo could have explained.

The baron's daughter was engaged to Albert of Morcerf, but the Count of Morcerf had now come under a cloud, for his betrayal of Ali Pasha had been made public; and perhaps the Count of Monte Cristo could have told how the truth came out at last. So the baron did not hesitate to break the engagement and to accept as the suitor for his daughter a dashing young man known as Count Cavalcanti, who had been introduced to Paris by Monte Cristo, but concerning whose antecedents nothing at all seemed to be known.

THE DOWNFALL OF THE FIRST OF DANTES' ENEMIES

The Count of Morcerf was tried for his betrayal of Ali, and seemed likely to be acquitted, when a veiled woman was brought to the place of trial and testified before the committee that she was the daughter of Ali Pasha, and that Morcerf had not only betrayed her father to the Turks, but had sold her and her mother into slavery. The veiled woman was Haidée, the ward of Monte Cristo. The Count of Morcerf was now a ruined man, and when his son Albert discovered the part that Monte Cristo had played, he publicly insulted the count at the Opera, and had the immediate satisfaction of being granted an opportunity to revenge himself in a duel, which was to take place the next morning, with pistols, in the Bois de Vincennes. But that night the Countess of Morcerf appealed to Monte Cristo not to kill her son. In the course of her tearful interview Mercédès learned from the lips of Edmond Dantès himself—for she had never doubted that Monte Cristo was he—how her husband had betrayed him, and the infamy of Danglars and Villefort as well.

"But what you ask of me you shall have," said he. "Your son shall live."

MERCEDES PLEADS WITH DANTES TO SPARE THE LIFE OF HER SON

"Oh," said she, seizing the count's hand and raising it to her lips—"oh, thank you, thank you, Edmond! Now you are exactly what I dreamt you were, such as I always loved you. Oh, now I may say so!"

"So much the better," replied Monte Cristo, "as that poor Edmond will not have long to be loved by you. Death is about to return to the tomb, the phantom to retire in darkness."

"What do you say, Edmond?"

"I say, since you command me, Mercédès, I must die."

"Die! And who told you so? Who talks of dying? Whence have you these ideas of death?"

"You do not suppose that, publicly outraged in the face of a whole theatre, in the presence of your friends and those of your son—challenged by a boy, who will glory in my pardon as in a victory—you do not suppose I can for one moment wish to live. What I most loved after you, Mercédès, was myself, my dignity, and that strength which rendered me superior to other men; that strength was my life. With one word you have crushed it, and I die."

But the duel was averted, as Albert publicly apologised to the count, and, furious that he had not been avenged by his son, Morcerf rushed to the house of Monte Cristo.

"I came to tell you," said Morcerf, "that as the young people of the present day will not fight, it remains for us to do it."

"So much the better," said Monte Cristo. "Are you prepared?"

DANTES' HOUR OF VENGEANCE ON HIS FIRST BETRAYER, FERNAND

"Yes, sir; and the absence of witnesses is of no account, as we know each other so little."

"Truly they are unnecessary," said Monte Cristo, "but for the reason that we know each other well. Are you not the soldier Fernand who deserted on the eve of Waterloo? Are you not the Lieutenant Fernand who served as guide and spy to the French army in Spain? Are you not the Captain Fernand who betrayed, sold, and murdered his benefactor, Ali? And have not all these Fernands, united, made the Lieutenant-General Count of Morcerf, peer of France?"

"Oh," cried the general, "wretch, to reproach me with my shame. Tell me your real name that I may pronounce it when I plunge my sword through your heart."

At this Monte Cristo, bounding to a dressing-room near his bedroom, quickly pulled off his coat and waistcoat and his cravat, and, donning a sailor's jacket and hat, was back in an instant. Morcerf, when he saw him again, felt his teeth chatter and his

legs sink under him, so that he had to support himself by a table.

"Fernand," cried Monte Cristo, "of my hundred names I need only tell you one to overwhelm you. But you guess it now, do you not?—or, rather, you remember it? For, notwithstanding all my sorrows and my tortures, I show you to-day a face which the happiness of revenge makes young again—a face you must often have seen in your dreams since your marriage with my betrothed!"

Gazing for a moment in terror at this man who seemed to have risen from the dead to avenge his wrongs, Morcerf turned, seeking the wall to support him, glided along close to it until he reached the door, by which he went out backwards, uttering the one distressing cry—"Edmond Dantes!"

Events marched rapidly now, and Paris had scarcely ceased talking of the suicide of the Count of Morcerf, when Cavalcanti was arrested for the murder of a fellow-convict named Caderousse, who had been blackmailing him. Caderousse had identified Cavalcanti as a former galley-slave named Benedetto.

THE FALL OF BARON DANGLARS AND HIS FLIGHT FROM FRANCE

It now came out that both Benedetto and Caderousse had been liberated by a mysterious Englishman who had spent large sums of money to enable them to escape. The Englishman's name was Lord Wilmore, but he and the Abbé Busoni and the Count of Monte Cristo were the same person, though the police knew it not!

Danglars fled from France, his great business in ruin, and with him he took a large sum of money belonging to the Paris hospitals.

In the household of Villefort, Monte Cristo had done nothing to bring vengeance on that evil man. He had seen from the first that Villefort's second wife took great interest in chemistry, because she was studying the art of poisoning, and he felt that revenge was already at work here. There had already been two mysterious deaths in the Villefort family, and now the beautiful Valentine, according to the doctor, seemed to be suffering from the early effects of some slow poison.

Maximilian Morrel, in despair of Valentine's life, rushed to Monte Cristo for his advice and assistance.

"Must I let one of the accursed race escape?" Monte Cristo asked himself, but decided, for Maximilian's sake, that he would save Valentine.

VENGEANCE AT WORK IN THE HOME OF DE VILLEFORT

Monte Cristo had bought the house adjoining that of Villefort, and, clearing out the tenants, had engaged workmen to make repairs and alterations. He had made them remove so much of the old wall between the two houses that it was a simple matter for him to take out the remaining stones and pass into a large cupboard in Valentine's room. Here the count watched while Valentine was asleep, and saw Madame de Villefort creep into the room and substitute for the medicine in Valentine's glass a dose of poison.

He then entered the room as Valentine awoke, but before she could cry out in amazement he made her keep silence, and told what he had seen. He threw half the draught into the fireplace, leaving the rest in the glass, and gave Valentine one of his famous pellets of hashish, which made her sink into a death-like sleep. He then retired to watch again, and in a little time Madame de Villefort returned.

Thinking that Valentine had drunk half of the poison, she threw the rest away, but Monte Cristo knew the poison, and, having brought some of the same with him, went in again and half filled the glass.

Next morning the doctor declared that Valentine was dead. In the glass he discovered poison, and as the same poison was found in madame's laboratory, there was no doubt of her guilt. She admitted all, and confessed that her object had been to make her own son the sole heir to Villefort's fortune.

THE TRAGIC FATE OF THE MAN WHO SENT DANTES TO THE CHATEAU D'IF

Madame de Villefort fell at her husband's feet. He addressed her with passionate words of reproach as he turned to leave her presence.

"Think of it, madame," he said, "if on my return justice has not been satisfied, I will denounce you with my own mouth, and arrest you with my own hands! I am going to the court to pronounce sentence of death on a murderer. If I find you alive on my return, you shall sleep to-night in gaol."

Madame sighed, her nerves gave way, and she sank on the carpet.

"Farewell, madame, farewell!" said her husband, as he left the room.

But Villefort little knew at the moment he spoke these burning words to the woman who was his wife that he himself was not going out to condemn a fellow-sinner, but to be himself condemned. For the man to whom he referred as a murderer was the so-called Count Cavalcanti, really Benedetto, and the night before the criminal had had a long interview with

IT WAS NO DREAM, FOR VALENTINE STOOD THERE, RESCUED FROM DEATH BY MONTE CRISTO

Bertuccio, who had disclosed to the prisoner the secret of his birth.

Benedetto appeared in court dressed in the most elegant manner and showing no sign of anxiety. Villefort had never been more eloquent than he was in describing to the court the character of the prisoner's crime. When the president of the court asked Benedetto his age, he replied:

"I am twenty-one years old; or, rather, I shall be in a few days, as I was born on the night of the 27th of September, 1817." M. de Villefort, who was busy taking down some notes, raised his head on hearing the date.

"Where were you born?" continued the president.

"At Auteuil, near Paris." M. de Villefort a second time raised his head, looked at Benedetto as if he had been gazing at the head of Medusa, and became livid. As for Benedetto, he gracefully wiped his lips with a fine cambric pocket-handkerchief.

"Your profession?"

"First I was a forger," answered Andrea, as calmly as possible; "then I became a thief; and lately have become an assassin."

A murmur, or, rather, a storm of indignation, burst from all parts of the assembly. The judges themselves appeared stupefied; and the jury manifested tokens of disgust for a stoicism so unexpected from a fashionable man. M. de Villefort pressed his hand upon his brow, which was now red and burning; then he suddenly rose, and looked around as though he had lost his senses.

The president next asked the accused to state his name, to which he politely

replied that, while he could not tell his own name, he knew his father's. His father, he declared, was Villefort, the public prosecutor! This statement made a great commotion in the court, and all eyes were on Villefort, while Benedetto continued to answer the questions of the president, and proved that he was the child whom Villefort would have buried alive that night when Bertuccio thought he had revenged himself upon Villefort in the garden of the house at 28, Rue de la Fontaine, Auteuil. But the public prosecutor himself confirmed the prisoner's story by admitting his guilt, and declaring that he held himself at the disposal of the public prosecutor who would succeed him.

As he spoke these words with a hoarse, choking voice, he staggered towards the door, and so from the court, which was stricken dumb with amazement for the moment. The president adjourned the sitting, and then all fell to discussing the strange turn of events.

VENGEANCE, SLOW BUT TERRIBLE, OVERTAKES THE ARCH-VILLAIN OF THE STORY

When Villefort arrived at his own house he found everything in confusion. Making his way to his wife's apartments, he had the horror of meeting her while she still lived, but just at the very instant when the poison she had taken did its work. His thoughts were now for his son, Edward, and after a search he found the child asleep, as he thought, upon a sofa. But as he lifted him up a folded paper fell from the child's breast, and, thunderstruck, his father dropped on his knees and let the body of the boy rest on the floor beside his mother. Villefort picked up the paper and read in his wife's writing:

"You know that I was a good mother, since it was for my son's sake I became criminal. A good mother cannot depart without her son."

This was more than the brain of man could endure, and Villefort turned from the tragic scene a raving madman, rushing wildly to the garden, and beginning to dig with a spade.

It was not long after this that the Baron Danglars was cleverly entrapped by some brigands in the catacombs of St. Sebastian, some little way outside Rome, and there, instead of being held to ransom, he was made to pay such fabulous sums for food and lodging that the money he had stolen from the charities on running away from Paris was very quickly transferred to the pockets of the brigands. But at length Monte Cristo appeared to the prisoner, and, after accusing him of his crimes, told him that he was in the hands of Edmond Dantès. At this Danglars uttered a cry and fell prostrate.

THE WAY THAT MONTE CRISTO PUNISHED BARON DANGLARS

"Rise," said the count. "Your life is safe; the same good fortune has not happened to your accomplices; one is mad, the other dead. Keep the 50,000 francs you have left, I give them to you. The 5,000,000 you stole from the hospitals has been restored by an unknown hand. And now eat and drink, and when you are satisfied you will be free."

Danglars stayed that night with the brigands, but in the morning he found himself lying near a stream. Being thirsty he dragged himself towards it, and as he stooped to drink he perceived that his hair had become quite white.

The vengeance of Edmond Dantès, so long delayed, so carefully and laboriously planned, was now complete, and it only remained for him to perform the last of his marvels, at the same time giving proof of his boundless generosity. Valentine de Villefort had been buried, and Maximilian was in despair; but Monte Cristo urged the young man to have patience and hope, and as his father had been a father to Edmond Dantès, so would Dantès be a father to him.

MONTE CRISTO MAKES A STRANGE BARGAIN WITH MAXIMILIAN MORREL

It seemed a strange thing to ask a lover whose sweetheart had been placed within the tomb to have hope and to come to Monte Cristo in one year. But this was the bargain they made.

Mercédès and her son had meanwhile given to charities the ill-gotten fortune left by Fernand. Monte Cristo had bought the house his father lived in at Marseilles, and in the garden there he had buried the dowry he had originally saved up when he was to be married to Mercédès. This house and the buried dowry he now gave to her, and there the beautiful countess now spent her days in the simplest way, her son helping her also from his earnings as an army officer.

When the year had passed during which Monte Cristo had bidden Maximilian Morrel to hope, the two met at Marseilles, and then went by yacht to the island of Monte Cristo. Seated in the mysterious cave, the count asked him whether he was still of the same mind, and he replied that nothing had touched his grief at the loss of Valentine. He was still resolved to die. It was yet three hours from the time until which Maximilian had promised to remain alive. The two friends talked much about the joys and sorrows of life as they sat there in that strange room, where the statues that stood around the banqueting-table had silver baskets always full of fruit, no matter how much was taken away. At last the count gave Maximilian a spoonful of a mysterious substance which was supposed to effect a painless death.

HOW TWO LOVERS WERE STRANGELY UNITED, THANKS TO MONTE CRISTO

Just as the young man seemed to be sinking softly into unconsciousness he saw Monte Cristo open a door leading to another room, and on the threshold, illumined by a strong light, stood a beautiful young woman, the picture of the beloved Valentine. This was no dream, and Morrel was not dying. It was indeed Valentine, who, when she was supposed to have died, was only in a trance, induced by the pellet given to her by the count. Monte Cristo had rescued her from the tomb, revived her, and for these twelve months, while the love of Morrel had stood its trial, Valentine had been the companion of Haidée. As the truth of his new-found happiness dawned upon the faithful young man, Monte Cristo had some real reward for the splendid service he had rendered the lovers; and when he learned that he was himself as much beloved by Haidée as Maximilian was by Valentine, it seemed to this strange and wonderful man that life might still have a greater happiness for him than the fulfilment of his vengeance.

Next morning, when Valentine and Maximilian met and went out to the beach, Jacopo, the captain of Monte Cristo's yacht, had a letter for them, which Morrel opened and read.

"My dear Maximilian,

"There is a felucca for you at anchor. Jacopo will conduct you to Leghorn, where M. Noirtier awaits his granddaughter, whom he wishes to bless before you lead her to the altar. All that is in this grotto, my friend, my house in the Champs Elysées, and my château at Tréport, are the marriage gifts bestowed by Edmond Dantès upon the son of his old master, Morrel. Mademoiselle de Villefort will share them with you; for I entreat her to give to the poor the immense fortune reverting to her from her father, now a madman, and her brother, who died last September with his mother. Tell the angel who will watch over your future destiny, Morrel, to pray sometimes for a man who, like Satan, thought himself, for an instant, equal to God, but who now acknowledges, with Christian humility, that God alone possesses supreme power and infinite wisdom. Perhaps those prayers may soften the remorse he feels in his heart. As for you, Morrel, this is the secret of my conduct towards you. There is neither happiness nor misery in the world; there is only the comparison of one state with another, nothing more. He who has felt the deepest grief is best able to experience supreme happiness. We must have felt what it is to die, Morrel, that we may appreciate the enjoyments of life.

"Live, then, and be happy, beloved children of my heart! And never forget that, until the day when God will deign to reveal the future to man, human wisdom is contained in these two words—*wait* and *hope*.

"Your friend,

"EDMOND DANTÈS,

"Count of Monte-Cristo."

THE LAST WORDS OF MONTE CRISTO AND THE LAST WE HEAR OF HIM

"But where is the count?" asked Morrel eagerly. Jacopo pointed towards the horizon where a white sail was visible.

"And where is Haidée?" asked Valentine. Jacopo still pointed towards the sail.

"Gone!" said Morrel. "Adieu, my friend. Who can say whether we shall ever meet them again?" His eyes were filled with tears.

"My friend," said Valentine, "has not the count just told us that all human wisdom is contained in these two words—*wait* and *hope?*"

The next Famous Books are on page 4537.

THE TOOTHWORT

This plant has a fleshy stem covered with tooth-like scales, and its drooping flowers are of a dull red colour. It grows among dead leaves and on the roots of trees, and spends the greater part of its life underground.

THE FIELD SCABIOUS

The pale lilac flowers of the field scabious are conspicuous in our grain-fields, although they are not confined to the field, but may be seen in the hedgerow. The stem is hairy, and the leaves vary in shape.

THE COMMON CHAMOMILE

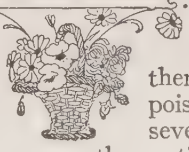
The name chamomile means ground apple, and refers to the pleasant apple-like smell of the plant. Made into tea, it is a good remedy for indigestion, and even to lie on a bed of chamomile and inhale the odour is helpful. It belongs to the Aster family.

THE HENBANE

This hairy and unattractive plant, with its dingy yellow flowers veined with dull purple, is not a native of this country, but was formerly cultivated in herb-gardens, and, escaping, became a wild flower. It has an unpleasant odour. Another name is the devil's eye.

LITTLE KNOWN BRITISH FLOWERS

CONTINUED FROM 4292



THERE are, as may be supposed, many flowering plants in Great Britain and elsewhere in Europe that Americans rarely hear of, even in literature. Some of them, if sufficiently handsome, are bought overseas as garden plants; a very few become naturalised to a slight extent, and some are used medicinally. Others, while favourites with people in the Old World, are still new to us.

THE CHAMOMILE

If we lived across the Atlantic we should find that perhaps the most widely known, on account of its former extensive use as a medicine, would be the chamomile, whose little heads, made up of many minute white-rayed flowers, are plucked and dried. From them is extracted the medicine. The chamomile is also frequently cultivated as a border plant, the flowers being prettily surrounded by feathery foliage. It is a member of the aster family.

THE HENBANE

The leaves of the ugly henbane, that are very poisonous, nevertheless will afford a quieting medicine, when properly treated. It belongs to the potato family, in which there are an amazing number of poisonous plants. We shall find several of them illustrated in other articles, — the thorn apple, the deadly and woody nightshades, etc. The henbane, "so called from the baneful effects of its seed upon poultry," was one of the plants that witches were supposed to use in their concoctions and ointments. It has become somewhat naturalised in waste places, so that we should remember that it is a tall plant of rank odour, with coarsely wavy-toothed leaves, sometimes nearly a foot long, hairy and gray-green. Its somewhat open, funnel-shaped corollas are greenish-yellow covered with a network of purple veins. The capsule is enclosed in the enlarged calyx.

THE FIELD SCABIOUS

The field scabious is very like the cultivated scabious in our gardens. Dozens of little flowers are grouped in a head, but it is not a composite, as the anthers are not joined in a ring,

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but one of the teasel family. Although tubular at the base, the flower flares out into a sort of one-sided brim, making a convenient landing-stage on which insects may perch. The scabiouses are very rich in honey, and some are very hairy to prevent snails and unwelcome insects from crawling up on the stems to steal it. All the flowers in a head display their anthers before the stigmas become ready to receive pollen. By this arrangement some of the pollen of each flower's anthers is likely to fall on its own pistil. It is supposed that if an insect brings pollen from some other flower it will be chosen by the pistil in preference to that of its own flower; but if not, the latter is sufficient to fertilise the seeds.

THE TOOTHWORT

One of the most curious plants that we should find, would be the toothwort, that spends most of its life underground, drawing its food from the roots of trees and shrubs, and thrusting out long, scaly shoots, but only once a year sending up into the air flower-bearing stems. These thick, fleshy stems are all white, or with a faint tinge of purple, (this pallid tint being very conspicuous on the brown, forest-floor) and are bowed at the top, which is covered with flowers, while the lower part is clothed in thick scales, which are all the leaves it possesses. If we dig carefully around it, and trace these stems downward, we shall find its rootlets attached to the rootlets of the tree by swollen suckers.

The toothwort, however, is only partially a parasite. It has very complete arrangements for cross-fertilising the flowers during their brief existence. The stigmas ripen before the anthers, and protrude from the corollas before these latter are fairly open. They can be pollinated, in this stage, by pollen from some other flower more fully developed, in which the anthers have been forced out of the corolla. The bee that brings the pollen, while seeking honey secreted by a cushion under the base of the pistil, has been well sprinkled with pollen, fallen from anther-cells that he has forced apart during his probing of the older flower. In case no insect visits a flower, the pistil dries up, and the stamens still further elongate and push their anthers so far out, that the wind empties their pockets, and the flour-like pollen falls on some young unshrivelled pistil, further down the spike.

THE SALAD BURNET

If we should walk over parts of the downs in southern England we might sometimes feel certain that somebody close at hand is slicing up cucumbers, owing to the odour that comes to our nostrils. A little close attention will prove that the scent arises from the spot where we are standing. If we gather one of the leaves of the plants beneath our feet we shall find that the scent is scattered because we are crushing them with our shoes.

The plant is the salad burnet, a member of the rose family, though our first sight of the flowers would never lead us to suppose it is so related. Its long, narrow leaves, which may be nearly a foot in length, lie flat on the ground, and are divided into a number of coarsely toothed oblong leaflets in pairs. From the centre of the leaf-rosette rise the flower-stalks, a foot or more high, on whose summit is a head of tiny purplish flowers without petals. The lower flowers in the cluster have stamens, the upper ones pistils, and the pollen is carried by the wind. The leaves used to be put into salads instead of cucumber.

THE SPURGE-LAUREL

A shrub that is occasionally cultivated for its evergreen foliage, and that may be found in flower in the earliest days of the year, is the spurge-laurel, a plant that very few persons appear to know, even in districts where it is common. It seems to be passed over as a laurel or a rhododendron. It has a branching stem three or four feet high, the greater part of which is bare of leaves. These are borne only on the upper part, and are large, leathery and evergreen, oval and lance-shaped, and somewhat drooping on all sides of the stem, forming a perfect roof over the blossoms. The yellow-green flowers are produced in drooping clusters from

THE WILD MIGNONETTE

We can all recognise this bushy little plant by the resemblance of its flowers to those of the garden mignonette. It is, however, stiffer and more upright, and the odour is not so fragrant.

THE COMMON CENTAURY

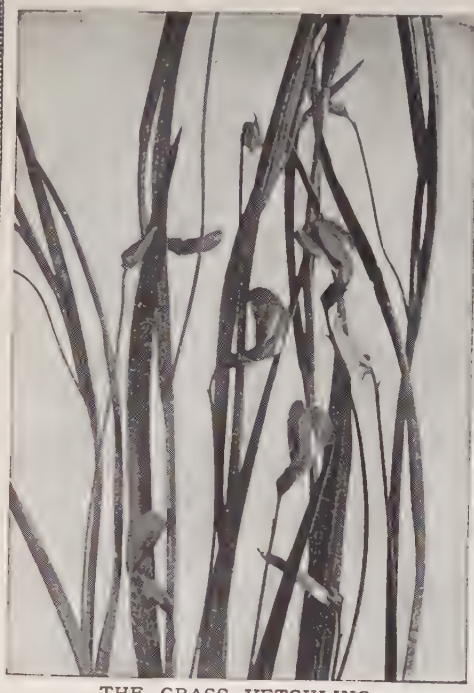
This neat little plant, with its pretty funnel-shaped flowers, varying in colour from the usual rose-pink to the rarer white, blossoms from June to September. The flowers close up at evening-time or when rain falls.

THE DWARF PLUME-THISTLE

Unlike the other thistles, this plant is practically stemless, and its solitary crimson flower nestles in the midst of a rosette of leaves. It is also called the ground-thistle.

THE NARROW-LEAVED EVERLASTING PEA

This plant, with its rosy-pink flowers and its greyish-green sword-shaped leaves, trails or climbs over the other plants among which it grows. It makes good fodder.



THE GRASS VETCHLING

It is impossible to discover the grass vetchling, or grass pea, until its flowers are out, for it looks exactly like grass, but its bright crimson flowers are very conspicuous.

THE SALAD BURNET

The leaves of this plant taste and smell like cucumber, and, as its name implies, the plant was once used a great deal for salads. The flower-heads are reddish in colour.

THE HEDGE-GARLIC

The smell of the hedge-garlic, or jack-by-the-hedge, is certainly not pleasant, but its clusters of white flowers are very dainty. In Wales it is often fried with bacon. When bruised the leaves give out an odour of garlic.

THE SPURGE-LAUREL

The yellow-green flowers of the spurge-laurel, that grow in clusters, change into bluish-black berries, so poisonous that quite a few are sufficient to cause death. The bark is often used by doctors to make a lotion.

THE TWAY-BLADE

Because of the two very large leaves, which are much more conspicuous than the stem with the little yellowish-green flowers, this plant received the name of tway-blade, or two-blade. It is coarse and covered with down.

THE BIRD'S-NEST ORCHIS

There is no green about the bird's-nest orchis, for the stem and flowers are alike, yellow-brown. The name is given because of the interlacing of the roots, as in a bird's nest. This plant looks very much like brown rape.

THE SPOTTED ORCHIS

The pyramid-like spike of lilac flowers, streaked with purple, and the lance-shaped leaves, spotted with purple, make the spotted orchis a noticeable plant wherever it grows, which is usually in moist meadows and woods.

THE GREATER BUTTERFLY ORCHIS

The greenish-white flowers of the greater butterfly orchis have little resemblance to a butterfly, although it is from a fancied likeness that the plant gets its name. Its pollen is carried by moths.

THE FLY-ORCHIS

This orchid grows as a slender plant a foot high, and is often passed unnoticed. It is not at all common, but its flowers, somewhat resembling a fly, are very pretty. Only two flowers are open at one time.

THE GREEN-WINGED ORCHIS

In general appearance this orchid is very much like the purple orchis, but its leaves are narrower and the flowers are darker in colour. It blooms from April to June in meadows as far north as Northumberland.

THE LESSER BUTTERFLY ORCHIS

This is the more common butterfly orchis, and the fragrant flowers are whiter and smaller than those of the greater butterfly orchis, shown on page 4421. It is the finest of our orchids, and is well worth the finding.

THE BEE-ORCHIS

This beautiful orchid is well worthy of its name, for, while other plants have been called after various objects whose resemblance it is difficult to trace, the flower of this plant bears a startling likeness to the bee.

among the leaves, and are tubular, with four spreading lobes at the mouth. They have eight stamens, a single pistil, and are sweet-scented. The early bees and butterflies know they can get refreshment in the spurge-laurel's flowers.

THE ORCHIDS

There are several orchids to be found in the wood. The earliest are the tway-blade, one species of which is also found in America, and the tall spotted orchis, with white flowers streaked and spotted with red or purple. Then there is the white helleborine, with pale leaves and pure white flowers that never open widely. These are all May flowers. In June we may find the strange, leafless, bird's-nest orchis, of much larger size, with yellow-brown flowers, near the roots of the beech; and in September there is the purple helleborine with stems three feet in height.

THE BUTTERFLY ORCHIS

In summer, should we come across a damp place on the wide heaths, we may find there the butterfly orchis. It has two large oblong leaves near the ground, and a stem a foot or more in height around which a crowd of whitish moths appear to be hovering. If we find them about twilight, they will look whiter and more moth-like than in the day-time. The truth is that what appears to be moths are the flowers of this orchis. Its pollen is carried by moths, and to suit their long tongues the nectar is stored in a long hollow spur that projects behind the flower. It is very likely that the appearance of the moth-like flowers attracts the real moths. When they find out their mistake, they are detained by the fragrance of the nectar.

THE BEE-ORCHIS

The downs, too, are a fine place for British wild orchids. We shall find there the beautiful bee-orchis, with its pink and white sepals and petals spread out like wings, and the broad, curved lip striped with brown to resemble a bee's body. The fine tip of it is curved underneath, and might well be the bee's sting. In some seasons this is abundant, but less so than is the fly-orchis, which has only about two flowers open at one time, and these look wonderfully like a fly with a brown body and a patch of blue on the back. The flower seems to have eyes and antennæ also.

Then there is a taller-growing kind, the green-man orchis, with many greenish flowers. A shorter kind, with green body and round head striped with red, is called the frog-orchis. A still smaller one, with dark purple and green flowers spotted with white, is called the dwarf orchis. It is very plentiful but not easily seen among the grass, unless we are really hunting for it.

Down in the meadow we shall find two kinds of orchis, the early purple orchis and the green-winged orchis. Though both are much alike in growth, and both have purple flowers (sepals as well as petals being coloured) the green-winged orchis has strong green lines along its sepals, which are half closed, so that, with the upper petals, they form a hood over the rest of the flower.

In all orchids there is only one two-celled anther, and its shape is peculiar. It is joined to the style of the pistil, and with it forms what is known as the column. On the lower part of this are two stigmas, usually broad and flat, run together so as to appear like one, above which is a narrow shelf-like projection (the beak) over which is the anther. The pollen is gathered into two pear-shaped masses which stand just within the pouches of the anther, and at the lower end of each there is a sticky knob, which lies "loosely in a cup-shaped envelope" which is the above-mentioned beak, projecting like the prow of a boat at the portal of the nectary. The bees or flies or wasps use the lower petal, or lip, as a platform and, in pushing their heads into the flower, they touch against the beak, which promptly breaks open and exposes the sticky knobs of the pollen-masses. These instantly stick to their heads, and are pulled out of their pouches when the insects retire. The remaining pollen falls over in front, where it looks like a pair of horns. When next the bees visit an orchid flower (and we know that,

as far as possible, the bees keep to one kind of flower on a journey) these drooping pollinia at once strike against the stigmas, where they leave some of the pollen.

HEDGE-GARLIC

The mere titles, jack-by-hedge and hedge-garlic, give us two main facts about this common plant, which is a British member of the cress family. It flowers in spring close in the shelter of the hedges, as well as farther afield. In its first year it produces rather large leaves, which are sometimes mistaken for those of the violet, but they are much too round to long confuse one; when bruised, these leaves give out a strong odour of garlic. Racemes of small white flowers spring from a tall stem, that has itself arisen from a thick root, which has been growing for a year past.

THE GRASS-PEA

In the meadow blooms the beautiful grass-pea, which has no tendrils, and no true leaves, but leaf-stalks flattened out until they resemble grass-leaves; and unless we saw the plant in flower we should pass it as a grass, especially as it grows among the grasses. But when its bright crimson flowers appear, there is no danger of mistaking it for any other plant. As a rule, there is only one flower on each long stalk. The seed-pods are flattened, and look like bent down grass blades.

THE EVERLASTING PEA

Another pea, the narrow-leaved everlasting pea, scrambles over the thickets, thrusting out its clusters of flowers (and, later, smooth pods) about two or three inches long, filled with little peas. This everlasting pea springs up every spring from a perennial, thick, creeping rootstock. We may find a plant that has climbed up fairly straight by means of its long, branched tendrils, reaching upwards for five or six feet. The stems appear broad and flattened, since two wings project from the main rounded portion, and reach from root to tip. Its leaves are divided into two long, sword-shaped leaflets. There are about ten flowers in every cluster, each with a rosy-red standard, or large upper petal, while the pair of wings that embrace the keel are purple.

These pea-blossoms, that are very closely allied, have a very pretty way for powdering their insect messengers. The five-petalled pea-flower has two wings, and an up-starting standard that represent three petals. The other two have joined together, except for a narrow slit at the top, forming a boat-shaped pouch, called a keel, in which snugly repose the pistil and stamens, the latter partly united, and all curved upwards so that the tip of the pistil lies in the tip of the keel. When a heavy bumble-bee alights on the keel, or on the convenient wings, by an interlocking device she presses down the keel, so that instantly the pistil and stamens pop out of the slit in the keel and project far enough to tap the insect on the under side, leaving some pollen there. Moreover, there is a little brush-like affair developed in connection with the style, that sweeps out the pollen from the keel the moment the bee alights. And, of course, the stigma collects whatever pollen has been previously deposited upon the bee by another flower. As soon as the bee has flown away, the keel springs back to its former position, and thus covers the stamens.

THE PINK-FLOWERED CENTAURY

The pink-flowered centaury is very closely allied to our pretty sabbatias, and although one would hardly suspect it, belongs to the gentian family. Its anthers twist spirally as they mature. As is also the case with the wild mignonette, the centaury is occasionally found in our waste places.

THE DWARF PLUME-THISTLE

The real Scotch thistle, that one which legend says saved Scotland from a Danish attacking party by causing one of them to shriek when he stepped on it, thus raising an alarm, has never been really identified. Personally I should think that the dwarf plume-thistle, cowering near the ground, might have answered the purpose. It certainly would be more easily trodden upon than the taller kinds. It probably needs its very effective armament of thorns to protect the soft flowerets and fleshy foliage from being devoured by browsing cattle.

THE NEXT STORY OF PLANTS IS ON PAGE 4487

ENGLAND'S EYES AND ARMS

CONTINUED FROM 4170

ONE of the things few inhabitants of Great Britain realise is that they live upon an island. In the ordinary affairs of life there is nothing to bring this fact to mind. Very many live far from the sea, in great towns, and there is nothing to suggest that they dwell upon a piece of land surrounded by water. But let them make up their minds to go, say, to Paris.

They realise then that they are islanders. They cross the sea, and go to Calais, and then on from there by train to Paris. But once arrived in Paris, there need be no more sea-voyaging for them, no matter what town in Europe, Africa, or Asia they wish to visit.

Shut up in their "right little, tight little island," they would become bankrupt and starve if they relied wholly upon themselves; while powerful foreign enemies would be only too ready to pounce down and invade it if they were not strong enough and watchful enough to prevent them. So they have the greatest navy the world has ever seen to protect their shores and their merchant ships. These ships must have harbours and ports into which to come when they return; they must have docks in which they can undergo repairs, and in which those engaged in commerce can unload. The waters leading to these ports are often shallow, rocky, and dangerous, so they have to train men, called pilots, who can guide the ships in and out of the channels to safety. For their guidance there are floating signals of iron, called buoys, which are lighted at night, so that, light or dark, the pilots or the captains may find their way in safety. In addition to buoys there are lighthouses to warn them away from points of danger, from rock and shoal, from quicksand and other hidden perils.

The English trade with every nation. In order that nothing shall be brought into the country without paying the proper tax, there are excise officers at all the ports.

But the men waiting are not always on the look-out simply for taxes; there are those brave fellows who man the lifeboat and go off to the assistance of ships in distress in times of storm. Lifeboats and lighthouses, buoys and beacons, ports and harbours and navy—these are institutions essential to the life of people like the English, whose back door and front door and highway to the world is the great everlasting sea.

BEACONS THAT LIGHT BRITAIN'S SHORES

This picture map of Great Britain gives us a good idea of the brilliant girdle of lighthouses and lightships round the coasts. Altogether nearly 900 lights illuminate the headlands and harbours of Great Britain and Ireland. When the sea sighs gently on the sand, or the waves in their fury lash the white foam, all through the long, black hours when the terrible fog blots out the world of water and sky, those silent sentinels of the sea keep watch and guard over the ships that pass in the night. Despite the fact that all these beacons send their guiding lights across the waters each night, nearly 4,000 wrecks and collisions take place round the shores in a single year.

THE FINGER-POSTS OF THE MEN AT SEA

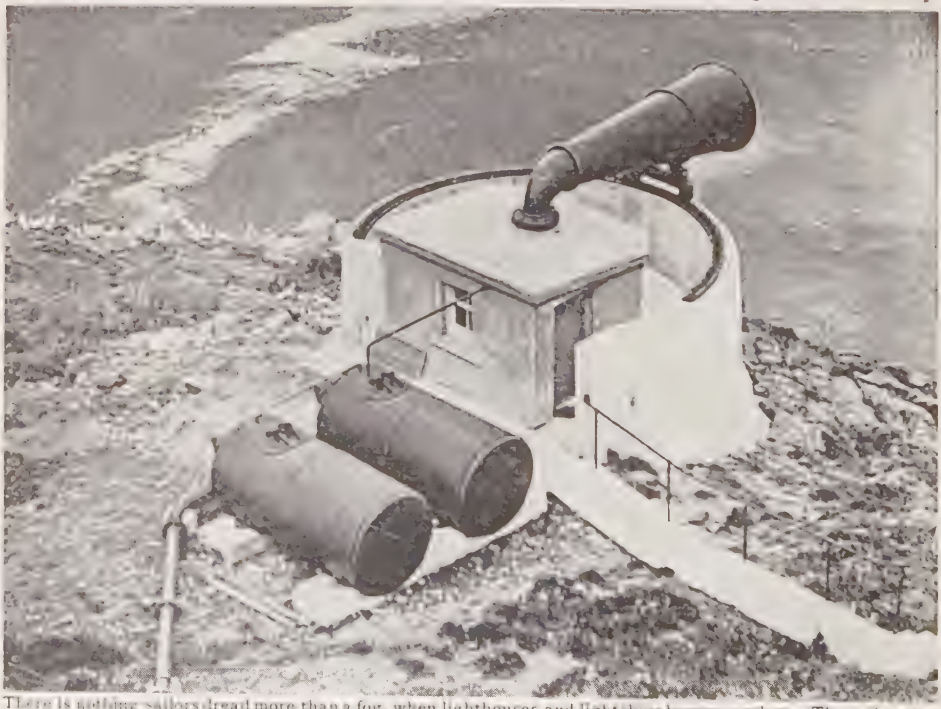
Three well-known high houses are shown on this page. In this picture we see the lighthouse on the Round Island at Scilly, a rocky crest rising from the sea that was a terrible danger to ships until this lighthouse was built.

Here we see the Longships lighthouse at Land's End, which has saved many a vessel from being dashed to pieces on the lonely rocks. The first lighthouse ever built, that of Pharos at Alexandria, was erected on an island.

This is the lighthouse at Corsewall Point, in Scotland. At the beginning of last century there were only 25 lighthouses round Britain, and their illuminating power was small. Now many lighthouses have brilliant electric lamps, and one which has a light equal to 30,000,000 candles can be seen from a mountain 150 miles away.

A FAMOUS LIGHTSHIP AND A FOGHORN

The Goodwin Sands, off the Kentish coast, are the most dangerous quicksands around England. Hundreds of wrecks have occurred there, and thousands of lives have been lost. In one brief hour a big ship of 1,000 tons disappeared entirely. Four lightships, one of which we see in this picture, warn vessels against this death-trap.



There is nothing sailors dread more than a fog, when lighthouses and light ships become useless. The sailors are like men deprived of their sight. Then it is that the foghorns begin to sound. A foghorn is often heard for twenty miles, but in some weathers only for one or two miles. This picture shows the Bass Rock foghorn.

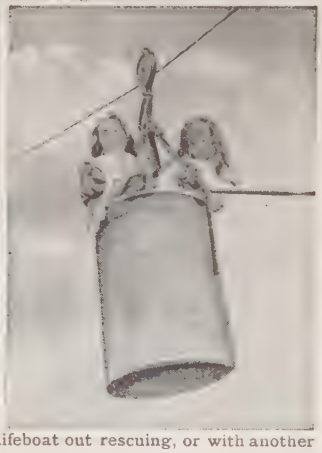
THE SPLENDID WORK OF THE LIFEBOAT

Few of us can look upon a staunch lifeboat, such as that shown here, without a feeling of pride. Each man of the crew is a hero, ready to go to sea in the teeth of a raging gale and risk his life to save others. There are about 280 lifeboats stationed around Britain. The lifeboat was invented by Lionel Lukin, a London carriage-builder.

In this picture we see the home-coming of a lifeboat with its cargo of mariners saved from a ship that has been wrecked. The sturdy sons of the sea that live round her shores are splendid specimens of British manhood. Their deeds of heroism will live for all time. They are types of the men that have made Britain what she is.

THE DAILY WORK OF THE COASTGUARD

The coastguard is a familiar sight at the seaside. Sometimes in the summer-time he appears to have little to do, but his work is very important. One of his chief duties is to save sailors whose vessels are wrecked on our coasts. This is done by firing a rocket to which is attached a life-line. A small line can be fired from a pistol, like that which the man in the left-hand picture is holding, but heavy lines are fired from guns, as shown on the right.



It is sometimes necessary to communicate with passing steamers, with a lifeboat out rescuing, or with another coastguard station. This is done by the semaphore shown in the picture on the left. The centre picture shows how a man can be brought ashore by means of the breeches buoy, which hangs on a pulley-wheel running on the life-line sent by the rocket. The third picture shows two little girls being saved from a wrecked ship.

The coastguard on the left is on the watch to see that no foreign craft is fishing within three miles of the shore, thus breaking a law on which the various nations have agreed. The coastguard on the right is claiming, in the king's name, a barrel that has been washed ashore. Anything washed ashore belongs to the Crown.

HOW THE SEA WASHES AWAY THE COASTS

Day and night the sea is doing its best to wash England away. On some parts of the East Coast the restless waves roll over places where centuries ago flourishing villages used to stand. The fight between the sea and the land has always been going on, and often the coast is carried away by the sea, as can be seen in this picture.

The pictures on this page show how the hungry waves have eaten up the land until the houses stand upon the very edge of the cliff where years ago they were built far back. The sea has driven the people from their homes, and any stormy night, when the sea dashes over the cliffs, the houses may slip and be swallowed up by the waves.

DEFENDING THE SHORES FROM THE SEA

At many seaside resorts we see great stone walls protecting the shores from the encroachments of the sea. Many millions of dollars are spent upon such walls, but the power of the sea is so enormous that tons of the strongest masonry may be washed away in a few hours by a storm. The sea-wall shown here is at Blankenese

We see here a sea-wall of concrete being built to prevent the sea from encroaching upon the land. Miles and miles of similar embankments have been made all round the British Isles. A lattice-work of metal is embedded in the concrete to hold it together. For embankments that will be under water, concrete is stronger than stonework.

MAKING A GREAT MODERN HARBOUR

Dover is not only an important port for traffic to and from the Continent, but it is now a great naval station, and the splendid national harbour which was commenced in 1897 will, when finished, enclose an area of over 600 acres. The total cost will amount to about twenty million dollars. Here we see part of the harbour works.

This picture, like the one above, shows us the yard at Dover where the huge concrete blocks for the harbour breakwaters are made. The blocks are cast in great wooden moulds, and each is dated and numbered. The largest blocks weigh 42 tons each. The wooden piles, or beams, used in making the harbour, measure 110 feet each, and weigh 10 tons. The remains of an old Roman pharos, or lighthouse, have been discovered at Dover,

TWO OF ENGLAND'S FINE NAVAL HARBOURS

Portland Harbour is one of the largest artificial harbours in the world. It is over 2,000 acres in extent, and is an important base for the warships. The great breakwater that encloses the harbour can be seen in this picture. It was built by convicts, who took 23 years to finish the work. At its foundations the breakwater is 270 feet wide.

Portsmouth Harbour, shown in this picture, is the most strongly fortified English harbour. Unlike Dover and Portland, it is a natural harbour, and is of the utmost importance to the fleet. It was in Portsmouth Harbour that the ill-fated battleship Royal George turned over and sank in 1782, about 800 persons being drowned, including the admiral, "brave Kempenfelt." It was Henry VIII. who made Portsmouth England's chief naval arsenal.

GUARDING THE COASTS FROM ENEMIES

Here is a band of bluejackets surrounded by some of the most terrible war-machines men have ever invented. The barrel-shaped cases wound round with ropes are submarine mines. They are full of deadly explosives, and are sunk in the sea at the entrance of harbours and outside big ports. Each mine could blow up a battleship.

When an enemy's battleship passes over them the mines are exploded by an electric current sent by a wire from the shore. These pictures show vividly with what terrific force they go off, sending the sea right up into the air. Terrible indeed is the fate of the poor ship [illegible] by these dreadful machines.

The curious object stretching across the water in this picture is not a bridge, but a boom, formed by joining together, side by side, massive beams of timber, each between 30 and 40 feet long, fitted with a number of great spikes. For years it had been thought that such a boom would prevent any hostile vessel from making into a harbour, but experiments have proved that a torpedo-boat can crash through it as if it were paper.

A WALL THAT COST TEN MILLION DOLLARS

Round the coast are some of the finest harbours in the world. Here we get a fine view of Plymouth Sound with its celebrated breakwater. Day after day men dropped huge blocks of stone into the sea until, after 29 years' work, the breakwater was completed. This great wall contains nearly 4,500,000 tons of stone.

This picture shows us the Hamoaze, as the mouth of the River Tamar is called. The great dockyard of Devonport, adjoining Plymouth, is situated here, and the Hamoaze can easily provide safe anchorage for a whole fleet of battleships. The smaller vessels that we see to the right of the warships are torpedo-boats.

The photographs on these pages are by Stephen Cribb, Valentine, Jenkins, Swinburne, R. W. Lord, J. C. Burrows, H. Goodwin, and others.

THE NEXT PICTURES OF FAMILIAR THINGS BEGIN ON PAGE 4477

The people of the ancient world thought that Atlas supported the vault of heaven on his shoulders.

COULD THE SKY FALL DOWN?

CONTINUED FROM 4345

THE sky could not fall down because there is really no such object as the thing we call the sky. It often appears to us as if we lived inside a great bowl turned upside down; the sun, the moon, and the stars seem to be fixed in that bowl, and to be moved round as it moves. In all ages men have had this idea, and we refer to it in such a phrase as "the heavenly sphere."

But when the movements of the heavenly bodies were more carefully studied, it was supposed that there were more spheres than one at different distances from us. In our clear climate we can get a clearer idea of the sky in the form of a great sphere than appears to men in some parts of the world.

If the sky were made like a great dome, we should indeed wonder what keeps it up. But what we see is only light reflected from the air of our own earth. The blue looks very far away, but from forty to sixty miles, at the very outside, is the greatest distance from which the light is reflected by the air to our eyes; and it is the effect of this reflection that we call the sky.

WHAT SET THE SUN ON FIRE?

The sun is not "on fire," in the same way that an ordinary fire is. We are certain of this for two reasons; first, because, at the high temperature of the sun, burning, or combustion, could not occur, curious though that at first seems, and, second, because it can be proved that the sun must long ago have burnt itself out if its heat and light were obtained from burning. It is possible to reckon about how much power the sun produces, and we are bound to look to something other than burning to account for it all. The question where the sun gets its power from is most important.

Burning is out of the question; heat must be produced by the atoms striking one another as the sun shrinks under the action of its own gravitation; light and heat falling upon the sun from other stars accounts for a little; and it is now thought that probably most of the sun's power is got from inside its own atoms. And they received their power, first of all, from the Author of all the power in the universe.

ARE THERE ANY STARS IN THE HEAVENS LARGER THAN THE SUN?

This is a question which science cannot answer with certainty until it is possible to find the distance of the stars. No telescope in existence enables us to see the size of a star. We never see its disc, but only a point of light. This gives some idea of the tremendous distances of the stars.

Now, if we cannot actually measure the size of a star because we cannot see anything to measure, our only means of information is the brightness of the star. But brightness, as such, tells us nothing. The little moon is far brighter to us than all the stars put together, not because it is bigger, but because it is so very near. Therefore, if we are to learn anything about the size of any star we must first find its distance, and then compare its *apparent* brightness with its distance. From this we can judge the star's *real* brightness; and from that we may reasonably make a guess as to its size.

This is not a very certain thing, because we are only judging from brightness, and a star has very different brightness at different stages in its history, though it may be of the same size all the time. Also, we may sometimes be able to notice what power of gravitation a star has upon a near neighbour, and as we know exactly what is the law of gravitation and mass, we can measure a star's mass, though not exactly its size, in this way.

And so we find that our sun is a star of only very moderate size. The heavens are filled with many that are probably far larger. A star named Canopus, which cannot be seen from our hemisphere, is reckoned to be probably thirty thousand times as large as our sun; and there may very well be many other stars, or suns, far larger still.

DOES THE SUN EVER MOVE?

Indeed, everything is always moving in one way or another. Galileo was imprisoned and silenced for saying that the earth moves, and now every child knows that it does. Once men thought that the sun remained perfectly still, while the planets and their moons moved round it. But we have learnt that that is not true. The sun has two movements. The first is interesting, but the less important. Like the earth, the sun spins, or rotates, upon itself, and in the same direction as the earth. Thus, we can notice a sun-spot appear at one side of the sun, travel across its face, disappear for several days, and then reappear where we saw it first.

But besides this movement of rotation, the sun has a movement of translation, as it is called—that is, an actual bodily movement from place to place. We do not doubt that all the other stars are in motion too. It used to be impossible to see any sort of arrangement or order in the movements of the sun and the other stars; but lately a German astronomer, Professor Kapteyn, and others following him, seem to have shown that the stars consist of two great hosts, which are streaming through or past each other in opposite directions and at different speeds, and they think that our sun belongs to one of these groups of stars. Of course, where the sun moves he carries all his family with him—planets, moons, comets, and so on—together with everything that is born and borne upon them. But neither astronomer nor other scientist can say where the sun is carrying us, nor what the result will some day be.

HOW DOES A SAILOR KNOW HIS WAY WHEN IN THE MIDDLE OF THE OCEAN?

For many long centuries the sailor who ventured out of sight of land had only the stars to guide himself by. As long as the stars are to be seen, they serve the sailor's turn. From the northern hemisphere of the earth, where we live, and where the greater number of mankind and all the great nations of the past have existed, there can always be seen, when the sky is clear, the North Star, or Polar Star, which indicates the north. Once this is known, of course, all directions are known.

There is good reason to suppose that, as in many other cases, the Polar Star has changed its position, even within the score of centuries or so that man has observed it. It is not now due north, but apparently at one time it was so. But, as everyone knows, the sailor nowadays uses the compass.

WHY DOES A COMPASS POINT TO THE NORTH?

As we know, the compass is simply a piece of iron, balanced so that it can move freely, and made of the kind of iron which is sensitive to a magnet. Now, the earth is itself a huge magnet, having a north magnetic pole and a south magnetic pole, the latter being discovered by Lieutenant Shackleton on his antarctic expedition. So what we call the north pole of a magnetic needle always points to the north, or, at any rate, to the north magnetic

pole, and thus the sailor can steer his course as well as, or better than, if he went by the North Star or any other star.

The so-called north pole of the magnet should really be called the north-seeking pole, for opposite magnetic poles attract each other, and it is really the south magnetic pole of the compass needle that turns towards the north magnetic pole of the earth.

WHAT DOES MATERIALISM MEAN?

We know the words *matter* and *material;* and the word *materialism,* made from them, though it has many rather different meanings, always means more or less the belief that matter is the all-important thing, and that mind is of less or no importance. We are all liable to be guilty, even those of us who are on our guard, of making this greatest of mistakes in one way or another; and the external difference between wisdom and folly depends not on how much a man knows, but whether he knows this.

It is materialism to worship the thing rather than what it means, or to care very much about forms and ceremonies, and to forget His words when He said: "For what shall it profit a man, if he shall gain the whole world, and lose his own soul?" or, "What shall a man give in exchange for his soul?" He also said: "The life is more than meat, and the body is more than raiment."

ARE PEOPLE MATERIALISTS TO-DAY?

Certainly, in our days, people are always making the mistake of thinking that it is enough to put notes together to make music, or words together to make poetry; that to have a voice is to be a singer; that a beautiful skin is more important than a beautiful soul; that the balls and bats make a ball-player; that the ships, and not the sailors, make a navy; that an industry which brings much gold into the country is well worth while, no matter how much life it destroys; that the question of national exports has only to do with cotton and coal, and not with the sending of our best youth of both sexes to the cities or to Canada or abroad, and receiving poorer specimens to the heart of the nation. All this is materialism, just like the materialism of the miser who sells his life for gold; and it will surely destroy the greatest nation as it will destroy any individual.

WILL ALL THE PEOPLE IN THE WORLD EVER SPEAK THE SAME LANGUAGE?

The answer is: Probably not. Spoken language differs very much from written language. It is surely certain, however, that some day there will be a common language which everyone will know, and which will be used for the business purposes of writing, and for speeches on occasions when people from different countries are present.

This language, whatever it is, will doubtless be based upon existing forms of speech, but it will certainly be a great deal better and simpler than Esperanto, or any of the artificial languages that were invented before it. The useful world language will very likely have as much Latin in it as Esperanto has, but it will certainly follow English in doing entirely without all the clumsy and unnecessary changes of gender and case and time which older languages are burdened with.

But it is a very different thing to say that all men will ever come to speak the same language. Such a notion allows nothing for invention, for local peculiarities, and for slang, which grows into regular languages in some degree. And the best proof that men will still continue to speak in their own way is to be found in what is now happening to English in the United States of America, in Australia, and South Africa. There we find that the spoken language, still more than the written language, is taking its own shape; and what is spoken gets in time to be written—at any rate, in the books that deal with the life of the country. It would really be a great pity if all the poetry, for instance, that is to come were going to be confined to one language, however good.

WHAT MAKES OUR TEETH CHATTER WHEN WE ARE COLD OR FRIGHTENED?

The first thing for us to do is to notice ourselves closely the next time that our teeth chatter, and to see exactly what it is that happens. We may sometimes have the opportunity of noticing what is really the same thing in other parts of our bodies; but for some reason or other the jaw is specially liable to this kind of disturbance, as we see also in the case of the disease called lockjaw. Well, what we notice is that the muscles which

close the jaw are being thrown into a quick series of brief little contractions. When they contract the jaw rises, and after the contraction it falls by its own weight; then the next contraction comes, and so makes the chattering.

When a muscle does this kind of thing, we call the act a spasm. Spasms are of two kinds: either the muscle contracts and stays so, as when the jaw is locked in lockjaw, or the spasm is in a series of little contractions, as when the jaw chatters. The great fact about all spasms, of either kind, is that they are independent of the will. We do not order the muscles to behave in this way, and we cannot stop their so behaving if they choose.

The causes of spasm and cramp, which is one kind of spasm, are very many, the only common fact about them all being that they act, apart from the will, upon muscles which really have no business to contract at all, except when the will commands them. Various kinds of emotion or feeling, such as fright, may cause a spasm. Cold, if not too extreme, appears to excite the ends of the nerves in muscles. A large number of poisons, such as strychnine and the poison of lockjaw, have the power of causing a spasm.

HOW DID MEN FIND THAT THERE IS COAL IN THE EARTH?

The coal-measures, as they are often called, form a layer in the earth's crust which is old and has had many other layers heaped up over it since the giant ferns that gave us our coal were alive; therefore we do not expect to find coal at or near the surface. But various things happen to and in the earth's crust which sometimes have curious results.

Wind and rain, the action of the sea and other causes, not yet well understood, may rub down and wash away the surface layers in places, and then what is beneath, such as coal, may be revealed. Or sometimes there may be greater and perhaps much more sudden happenings in the earth's crust, due to the action of the heat that is imprisoned beneath it, or to the breakage of a layer owing to the increased weight of the layers above it, or due to the production of heat by means of radium and the other elements which belong to the same group.

In this way there were possibly found certain curious and easily broken black stones which, unlike all other stones, would burn. This may have happened when men were quarrying or cutting a little distance down into the earth for some other purpose. Afterwards, it was found how the coal lay and in what parts of the earth it is most readily obtained.

We have by this time probably discovered most places in this country where coal can be obtained, at least for anything at all like its present cost; and as we have too little water-power in our country to replace the coal when it is finished, we cannot say what is to take its place. We ought to begin now, at least, to be sure that we do not waste the coal.

IF WE SWING A ROPE AND THEN LEAVE IT, WHY DOES IT GO ON SWINGING?

The question really might be: "Why does the rope *ever stop* swinging?" Let us see why this is so. When we swing a rope, something has happened in our muscles. A store of power, derived from our food, and, before that, from the sun, has been turned into motion, which is another form of power.

By catching hold of the rope at this moment we handed the motion made in our muscles over to the rope, and there it is now. Nothing is ever destroyed: and just as the chemist, working with his test-tubes, must account for every atom of matter he works with, so in this case we must account for every particle of power and motion that is concerned. Therefore we shall naturally expect that the rope will go on swinging for ever. If it stops, the only possible reason must be that it has somehow lost its motion in doing something else.

DOES A ROPE STOP AT THE END OF EACH SWING?

It is true that at the end of each swing the rope is still for a moment before it returns, just as a pendulum is. The motion of the rope has been turned into another form of energy—the energy which may be called energy of position, or power to fall; and then the rope, by falling, turns this energy back into motion again. If we could set a rope swinging in a vacuum—a space as nearly as possible emptied of air—it would swing for a much longer time.

MIGHTY FOUNTAINS OF BOILING WATER

Among the beauties and wonders of New Zealand are its geysers, or fountains of steam and boiling water. Underground there is great heat from volcanoes. This makes the water so hot that deep down in the earth it turns to steam and explodes, forcing the cooler water above, in brilliant and mighty torrents, high into the air.

When the steam from below can get away quickly, carrying the colder water above, it simply makes a great fountain; but when there is so much steam that it cannot get out fast enough, it explodes like a boiler bursting, and the result is, as we see in these two pictures of the Waimangu Geyser in New Zealand, most awe-inspiring.

If we could set it going in a perfect vacuum, if it were hung so that no friction was possible, and if none of its motion were used up in doing anything to the shape and structure of the strands of the rope itself, it would have to swing for ever. It would have no way of spending the motion which it could not destroy. So here is the answer to the previous question which we might have asked if we had remembered the great law that nothing is destroyed.

HOW DOES COLOUR GET INTO A BUD BEFORE IT IS OPENED?

We might as well ask why it should not. The sun does not make the colour of a flower directly, as if it painted the colour on the petals by shining on them! Of course the life, and therefore the colours, of the plant depend upon the sun in the long run, but the colour of the petals is not made in any direct way by the sun.

The plant begins in a seed, which is already constructed in a wonderful way that no one has yet been able to understand. Among the thousands of parts of the seed there are some which, though they have no colour themselves, are yet able to make the colours proper to the various parts of the plant when the time comes. These things in the seed, which *determine* the future of the plant, are often called *determinants* for that reason.

HOW DOES THE SEED MAKE THE COLOURS OF A PLANT?

Things called ferments, which may be described as tiny chemists, are probably produced in the seed, and make compounds impossible to be made in any other way. The right ferment starts the right process going in each part of the plant, and the end of it is the production of a green, a blue, a red, or a white chemical compound.

This happens because it is the nature of the plant. But without nurture the nature of no living thing can realise itself; and the nurture required by the plant when it is developing is much the same as that which it requires when it is grown up—water, salts, light, and air. Light is necessary because light is power, and every chemist, even the ferment in a plant, requires power to work with. That is why the plant produces early green leaves long before the bud, so as to be able to catch the rays of sunlight and use them to make the colours of the bud and the very substance of the bud itself.

WHERE DOES THE BREATH THAT WE BREATHE OUT GO TO?

Fortunately for us, the first thing that happens to the breath we breathe out is that it ascends. It does this because it is, almost always, much warmer than the air it meets, and is therefore lighter, and must rise. This means that when next we breathe in, we have unbreathed air opposite our noses, and not the used-up air we have just breathed out. This difference of temperature is the first thing that decides what happens to expired air, as the proper name for it is; but that is not all. All gases, when exposed to other gases, tend to get mixed with them, until, if nothing interferes, all the various gases are equally distributed. This very important fact about gases is called diffusion.

Expired air has much more carbonic acid in it, and, as a rule, much more water-vapour, than has ordinary air. These gases, then, at once begin to diffuse into the air round them. But the proportion of oxygen is much higher in the air generally than in expired air, and so oxygen diffuses into it from outside. This process of mixture sounds very simple, but is very remarkable when we come to study it, for the atoms of each particular gas seem to behave as if all the other kinds of gas were not there at all, and act simply according to the number of atoms like themselves that they find around them.

Diffusion is due to the fact that gases are made up of quickly moving atoms, and these travel about to wherever there are few of themselves from wherever there are more, but take no notice of atoms of any other kind.

Another part of this question deals with what happens to the carbonic acid of expired air. It makes food for plants, which feed on it by their leaves. So we feed plants and they feed us, which is exactly as it should be.

WHY DOES HEAT CRACK WOOD?

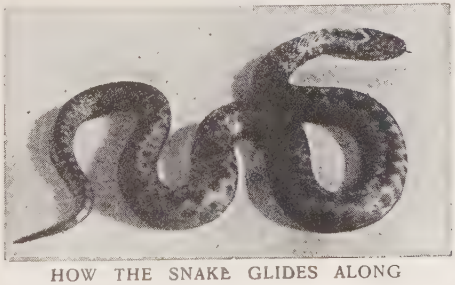
It would be easier to answer this question if more were known about the way in which matter is held together. If we knew why one end of a

stick moves when the other end is moved, we should have something to go upon; but we cannot answer even that question, though it looks simple enough. There are two distinct problems to solve. One deals with the way in which things not made by life are held together, and the other deals with wood and other things made and built up by life. We know very little of either of these, but rather more about living things than the others. At least we can find something of their structure when we examine them under the microscope; and we can observe what are some of the effects of heat.

There is a good deal of water in wood. Now, water occupies space, and, like other liquids, will not be squeezed. When wood is heated and the water is driven off, this means that the whole balance of forces holding the wood together must be interfered with. Another reason why wood cracks when heated may be that the heat melts and destroys certain substances which hold the fibres of the wood together.

HOW DO SNAKES MOVE ALONG?

To watch a snake or a serpent gliding smoothly and silently along the ground is to see one of the most marvellous things in natural history. Indeed, the wisest man who ever lived confessed that the motion of a snake was one of the things that he could



HOW THE SNAKE GLIDES ALONG

not understand. Three parts of the snake's body take part in its movement—the backbone, the ribs, and the large horny scales underneath. It is by muscles moving these parts in certain ways that the snake glides.

As a matter of fact, a snake walks on the ends of its ribs—a very curious use for ribs to be put to. These ribs are very numerous, there being one for each part of the backbone. Each rib is also fixed to one of the large belly scales. By the muscles acting on the ribs, these scales are moved forward one after the other, their edges catching the ground, and the result is a rapid gliding motion. We notice that the body always moves from side to side in a wriggling or writhing manner, never up and down, as is sometimes shown in pictures. It is the very flexible backbone that allows of this writhing movement, and the structure of the backbone also allows of its being broken rather easily.

So that the movement of a snake is really very like what happens when a boat is being rowed through the water. The ribs correspond to the oars, the ribs gripping the ground by the scales to which they are attached, just as the oars grip the water—only the snake's back is flexible, while a boat is rigid. Therefore, if we watch the snake in motion, we see the movement pass along its whole length in a wavy manner, as each rib on each side moves after the last in rapid succession.

WHY DOES STARCH STIFFEN CLOTHES?

Starch is a very curious chemical compound, with its own way of behaving. Like the proteins—white of egg, and so on—it consists of very large molecules, so large that no one knows how many atoms each one contains. It consists of molecules so big that we can scarcely say that it really dissolves, certainly not as sugar or salt, which have small molecules, dissolve. But it forms a sort of solution with water, and when the water evaporates the starch is left behind.

Starch is called one of the substances that are not at all volatile—that is, able to fly off into the air. The big molecules of the starch, left behind in the clothing, form a sort of stiff layer by all holding together. We know how water affects this when we see how our collar gets limp if we perspire.

WHY DO WE NOT LAUGH WHEN WE TICKLE OURSELVES?

This is an exceedingly interesting question, because we cannot think about it without discovering a most important fact about our minds and the way in which they are made for use, for safety, and for the purposes of living. If we do not have this mighty key to mind and body, we shall never understand why it is that the same thing should make

us laugh and squirm when someone else does it, and have no effect at all when we do it ourselves. The whole point and purpose of the feeling in our skins, and of what happens—such as laughing and squirming—when this feeling is aroused in particular ways, is that it gives us information about what is not ourselves, and leads us to protect ourselves.

Our minds have so much power over the way in which our bodies reply to things that when we know the cause of the feeling to be ourselves, and therefore nothing we need concern ourselves about, the body feels no inclination to behave as it does at all other times. The results of tickling are what is called a reflex action, and we learn from this case that a reflex action is a reply to the outside world.

If it is sought to call forth the reply by what we know not to be really the outside world—as when we tickle ourselves—then the body does not trouble. This shows how reflex actions are controlled by and adjusted to the needs of the body as a whole.

DO ANIMALS DREAM AS WE DO?

As we cannot ask animals the answer to this question, we must find it out as best we can by arguing from other facts we know. The case is the same regarding babies and very small children before they can speak. But in all these instances we have quite good reason to believe that dreams occur, just as they occur among ourselves. As soon as children can tell us about themselves we find that they have dreams, and so we naturally expect that they must have dreams of some kind even sooner.

Then, as regards children, and animals too, we know that their brains or senses are made on the same principles as ours in every respect. They are exposed to the same influences as ourselves, and so it would be very curious indeed if the same results, such as dreams, did not follow from what are practically the same causes.

In dreams we have feelings of various kinds, and just as our faces largely express our feelings when we are awake, so they do when we are asleep. If we observe the ways in which such an animal as a dog, for instance, expresses its feelings when awake, we may look out to see whether it ever shows the same sort of expression when it is asleep—perhaps only for a very brief moment, but clearly, nevertheless.

We do find signs in animals which plainly show that they are having feelings of one kind or another—and that means that they are dreaming. Of course, their dreams will differ from ours, just as ours differ. A musician and a painter have very different dreams, and we should expect a dog, in which the smell part of the brain is very important, to dream smells, just as we dream sights and sounds.

IS PHRENOLOGY TRUE?

There is certainly nothing at all absurd in the idea of phrenology, which is that by examining the head we may tell something of the brain, and therefore something about the person to whom the brain belongs.

That is one point. But, unfortunately, there is another. The idea is reasonable, but it cannot be used, because the facts of the skull and the brain are against it. To begin with, the shape of the head and the shape of the brain do not much correspond—certainly not to an extent that would be of any use for phrenology. The skull is made of bones built in two sheets, with a space between. This space is in parts very large, and is filled with air or a loose, bony tissue.

This is the way in which the "bumps" are made upon the outside of the skull. Instead of corresponding to the brain, as the phrenologists pretend, they only correspond either to air or loose, bony stuff.

DOES THE SHAPE OF THE BRAIN MEAN ANYTHING?

The fact that the shape of the head does not correspond to the shape of the brain is one fatal objection to phrenology. Another is still more serious. It is that the differences in the mere outside shape, and even in the size and weight, of brains are probably of little or no importance. The differences between brains are of very great importance, but they are to be found only in the grey matter of the various parts, and in the number and shape and arrangement of the cells that compose the grey matter. These differences can be seen only when the brain is finely sliced and thoroughly and carefully examined by the microscope.

The next Questions are on page 4545.

THE FRIEND OF THE SLAVES

CONTINUED FROM 4336

LADY BAKER

It is the glory of Britain that she has done more than any other country to abolish the hateful slave trade, not only from her own possessions, but from the very face of the earth. Long after the slaves were freed in her colonies, as a result of the efforts of Wilberforce, of whom we read on page 3700, the slave trade flourished as much as ever in Africa, and, although it has been greatly checked, it is still one of the evils of the Dark Continent.

The first real step taken to stop the slave trade in Central Africa itself was made by Sir Samuel Baker, an intrepid English traveller, who, with his brave young wife, went to the stronghold of the traffic in Africa, and grappled with it there. Sir Samuel was given, by the Khedive of Egypt, command of an expedition to suppress the slave trade, and he had under him a force of 1,645 soldiers; but the Egyptian officials in the Sudan, who made large sums of money by the wicked traffic, put every obstacle in the way of Sir Samuel Baker, and a man of less determination and spirit than himself would have given up the work in despair.

Everything seemed against the brave leader. The river fell low, and his steamers could not travel, and, instead of leaving Khartoum with vessels and beasts of burden, he had to go on without steamers and without a single transport animal. His British pluck, however, made him attempt what seemed the impossible, and the gallant Lady Baker, who was the first white woman ever to visit these parts, supported him heroically in his determination. Splendid work was done. On one occasion three boats, belonging to the governor of Fashoda, were seen approaching. Sir Samuel interviewed the governor and asked if he carried slaves on board. The official appeared greatly shocked, and said he was only collecting taxes. But when the vessels were examined, over seventy slaves were found on board, and eighty-four others were concealed on shore. This was an official who had declared to Sir Samuel that he had himself suppressed the traffic, and no slave trader dared have a station in his district.

Sir Samuel and Lady Baker released all the slaves instantly, to the intense joy of these poor people, and the bitter resentment of the governor.

At another time a vessel was seen passing far out in the middle of the river. She was stopped, and the indignant captain declared that he carried no slaves, but only grain. When the corn was prodded with a ramrod from a rifle, there was a

stifled cry from beneath the grain, and a negro woman was pulled out. The whole of the corn was then removed, and 150 slaves were released.

Sir Samuel soon found out not only that Egyptian officials were the principal slave dealers, but that the Government that had sent him to suppress the trade had given to a trader a permit allowing him the exclusive right to take slaves over an area of 90,000 square miles!

Treacherous officers in his own army and mutiny among the troops did not move him; and when he heard that the officers and men had determined to give up the expedition and return to Khartoum, thus leaving the slaves to their fate, he wrote in his diary: "Not a man shall go back, except by my orders." And yet, strong and firm as he could be, Sir Samuel was moved to tears by the sight of a little slave boy of eleven, who escaped to his boat, covered with wounds.

The force of 1,645 men was reduced to 502 all told, but the brave leader kept heart. "I did not despair," he says. "I determined that this reduction of military force should not paralyse the activity of the expedition, and that in spite of every intrigue I would succeed in the main object of the enterprise; the slave trade should be suppressed." Continuing south, he came with his wife and a small force to Masindi, near the Victoria Nyanza. The king appeared friendly, but Sir Samuel Baker felt it necessary to take precautions. The continued friendliness of the king disarmed him somewhat, and then one evening, while Sir Samuel was walking up and down, talking to Lady Baker, fire was opened upon them from the neighbouring bushes. Fortunately they escaped, but the station was surrounded by thousands of armed blacks, who were repulsed only with difficulty.

Sir Samuel's good work has since borne fruit, for the slave trade has now been suppressed in the parts which he visited. At the close of his book on the expedition he says: "I must acknowledge the able assistance that I have received, in common with every person connected with the inland expedition, from my wife, who cared for the sick when we were without a medical man, and whose gentle aid brought comfort to many whose strength might otherwise have failed."

Livingstone, the missionary, in one of his last letters, says of Baker: "He is now employed in a more noble work than the discovery of the Nile sources, and if he succeeds in suppressing the slave trade, the boon he will bestow on humanity will be of far higher value than all my sources together."

A WOMAN WHO SAVED HER FAMILY

A LADY was spending a holiday in Switzerland with her two children, and one day, desiring to reach a valley on the other side of the mountains, she ordered a carriage to drive the family over the pass.

Now, most mountain passes have one or more dangerous spots on the road, where a driver has to use all his skill to keep his vehicle from falling off the narrow road into some depth below. In this case there were three horses to draw the carriage—a leader in front and two abreast behind him.

All went well till the carriage came to an awkward place in the road, where rocks overhung it on one side, and a steep precipice shelved down on the other into the valley hundreds of feet below. Just at the critical moment the leading horse became scared at something, turned aside towards the precipice, then, sticking his forefeet over it on the top of the incline, tossed his head and stiffened his body, preparatory to making a dash forward.

A scream from the children, and the poor frightened animal would have plunged them all into the valley below. The driver quite lost his presence of mind, and stared helplessly in front of him, as though he were paralysed.

But the mother in the carriage behind knew that a moment's delay meant death, and, with the courage born of mother-love, jumped out on the road, and, quick as thought, ran to the head of the leader, seized the bridle with her right hand, and, covering his eyes as well as she could with her left, spoke soothing words as she tried to back him up on to the road. She found this very difficult to do, but in the end she managed it, and so saved them all from impending destruction.

The next Golden Deeds are on page 4557.

THOMAS ALVA EDISON

We have just been to a picture show, perhaps, and have laughed ourselves weary over the funny things we have seen; or perhaps we have watched the telegraph operator tick out our message to a friend who lives hundreds of miles away; or perhaps we have been trying out some new records of the latest songs on our phonograph and, the dusk closing in about us, we have switched on the electric light to enable us to see in picking out the records. We take all these things — the telegraph instrument, the moving picture machine, the electric light so very much for granted that probably it has never occurred to us to wonder how we got them. And yet we hear the name of their inventor — Thomas Alva Edison, the "Modern day Wizard" — a half a dozen times a month.

It is Thomas Edison to whom we owe the phonograph, the perfection of the telegraph, of the electric light, of the megaphone, of the electric train, of the moving picture machine, and half a hundred other things which it seems that we cou'd not do without. Thomas Edison is looked upon as the greatest inventor of the present century; he has a half a dozen or more factories engaged in making his inventions alone; scarcely a month passes in which he does not take out a patent in Washington, and from all parts of the world men come to seek the presence of the Master.

And yet Thomas Alva Edison, great as an inventor, is remarkably simple as a man. Some sixty odd years ago he began life as a poor boy in a little Ohio town. He went to school for only two months in his life, but his mother, who had been a school teacher, taught him her little fund of knowledge, and, what was more important, taught him something he might never have learned in school, namely, to think for himself.

A NEWSBOY ON THE TRAIN

As a boy he did not seem remarkably unlike other lads of his age. When he was seven he began to sell newspapers on the Grank Trunk Railroad in Michigan. His train left Port Huron at 7 A. M. and made its southward trip to Detroit in about three hours. This gave a stay in that city from 10 A. M. until late afternoon. In those days no use was made of the smoking compartment, as there was no ventilation, and it was turned over to young Edison, who not only kept papers there, but soon had it fitted up as a laboratory, where he spent every spare moment fussing with chemicals, joyously absorbed in "inventing" things. Here in this eager-eyed newsboy was the born inventor.

One day a catastrophe occurred The train which was running at thirty miles an hour over a piece of poorly laid track, was thrown suddenly aside with a violent lurch, and before young Edison could catch it, a stick of phosphorus was jarred from its shelf, fell to the floor and burst into flame. The car took fire, and the boy, in dismay, was still trying to quench the blaze when the conductor, a quick-tempered Scotchman, who acted also as a baggage-master, hastened to the scene with water and saved his car. On the arrival at Mount Clemens, its next stop, the young inventor and his entire outfit, laboratory and all, were promptly ejected by the outraged conductor, and the train then moved off, leaving Edison on the platform, tearful and indignant, in the midst of his beloved but ruined possessions. It was through this incident that Edison acquired the deafness that has persisted all through his life, a severe box of the ears from the scorched

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and angry conductor being the direct cause of his infirmity.

THE BOY PROVES HIMSELF A HERO

But soon Edison was back at work again. The train on which he sold papers did way-freight work and shunting at Mount Clemens Station. One warm August in 1862, while the shunting was under way, young Edison was loitering about the platform, his glazed cap pulled low down over his eyes to keep out the glare of the sun. His glance wandered idly down the tracks where a train was rapidly approaching. Suddenly all his languor vanished. With a breathless exclamation he dashed his cap and papers on the ground and tore down the main track. A little boy was playing in front of the on-coming train. Edison caught the child by the waist and rolled to one side — not a moment too soon, for the wheel of the car struck his heel. The two boys were picked up by the frightened train hands and carried to the platform, but though cut and bruised, both were quite safe. The grateful father, who was the station-master at Mount Clemens, unable to reward Edison financially, at once offered to teach the boy the art of train telegraphy. It is needless to say the proposal was eagerly accepted.

THE YOUNG TELEGRAPH OPERATOR

Edison first obtained regular employment as a telegraph operator at Indianapolis when he was eighteen years old. He received a small salary for day-work in the railroad office there, and at night he used to receive newspaper reports for practice. "The regular operator was a man given to copious libations, who was glad enough to sleep off their effects while Edison and a young friend of his did the work." But even in the earlier days of his career as a telegraph operator, Edison was more of an inventor than anything else.

"Anything connected with the difficulties of telegraphy had a fascination for him. He lost many a place because of unpardonable blunders due to his passion for improvement. At Indianapolis he kept reports waiting while he experimented with new devices for receiving them. At Louisville, in procuring some sulphuric acid at night for his experiments, he tipped over a carboy of it, ruining the handsome outfit of a banking establishment below. At Cincinnati he abandoned the office on every pretext to hasten to the Mechanics' Library to pass his day in reading." At Stratford, Canada, being required to report the word "Six" every half hour to the manager to show that he was awake and on duty, he rigged up a wheel to do it for him.

THE YOUNG INVENTOR

Edison was once asked what was his first invention.

"Well," said he in reply, "my first appearance at the Patent Office was in 1868, when I was twenty-one, with an ingenious contrivance which I called the electrical vote recorder. I had been impressed with the enormous waste of time in Congress and the State Legislatures by the taking of votes. More than half an hour was sometimes required to count the 'Ayes' and 'Noes.' So I devised a machine somewhat on the plan of the hotel annunciator. In front of each member's desk were to have been two buttons, one for 'Aye' and the other for 'No' and by the side of the Speaker's desk a frame with two dials, one showing the total of 'Ayes' and the other the total of 'Noes.' When the vote was called for, each member could press the button he wished and the result would appear automatically before the Speaker, who could glance at the dials and announce the result. I thought my fortune was made. I interested a moneyed man in the thing and we went together to Washington, where we soon found the right man to get the machine adopted. Imagine my feelings when, in a horrified tone, the man exclaimed: 'Young man, that won't do at all! That is just what we do not want. Your invention would destroy the only hope the minority have of influencing legislation.' I saw the force of his remarks, and the vote recorder got no further than the Patent Office."

Edison obtained his first large money returns from the sale of an improvement of the instruments used to record stock

broker's quotations, commonly known as "tickers." His success in this brought a contract to manufacture some hundreds of "tickers," and this adventure into the manufacturing line he carried through with some success. Yet, in speaking of it afterward, he said, "I was a poor manufacturer, because I could not let well enough alone. My first impulse upon taking any apparatus into my hand, from an egg-beater to an electric-motor, is to seek a way of improving it. Therefore, as soon as I have finished a machine I am anxious to take it apart again in order to make an experiment. That is a costly mania for a manufacturer."

It was Edison's success with the "tickers" that induced several New York capitalists to accept his offer to experiment with the incandescent electric light, they to pay all expenses and to share in the profits of the invention. Edison retired to Menlo Park, about twenty-five miles beyond Newark, N. J., to work out his invention. Patiently he experimented and re-experimented. At one time all the lights he had started burning suddenly went out, one after the other. Edison was stunned by the catastrophe. He began a series of exciting and exhaustive experiments. For five days he remained day and night at the laboratory. His eyes grew weak, studying the brilliant glow of the electric light. He could not sleep, for the moment he closed his eyes a dozen new tests for the lamp suggested themselves. To add to the discomfiture of the inventor, a professor of physics in one of the well-known colleges declared in a newspaper article that the Edison lamp would never last long enough to pay for itself.

"I'll make a statue of that man," said Edison, grimly, "and I'll light it brilliantly with Edison lamps and inscribe it: 'This is the man who said the Edison lamp would not burn.'"

Such persistency would not fail to win out. And it did. With the perfection of the incandescent lamp came the formation of the Edison General Electric Company, involving the consolidation of the immediate Edison manufacturing interests in electric light. To-day this company employs from twenty to twenty-five thousand people.

THE PHONOGRAPH

When Edison was barely thirty years old he astounded the world by inventing the phonograph. He had a large laboratory now with a staff of men working under his directions. One day he draughted a sketch and gave it to a workman to make up into a machine. When the workman, who was a German named John Kruesi, brought the completed machine to him, Edison announced that he was going to record talking and then have the instrument give it back.

"To me it seems most absurd," shrugged Kruesi.

Edison bent over the machine and shouted lustily:

"Mary had a little lamb,
Its fleece was white as snow,
And everywhere that Mary went
That lamb was sure to go."

Then he adjusted the reproducer.

"Mary had a little lamb," the machine announced squeakily. For a moment even Edison himself was taken aback. John Kruesi looked at the simple little instrument with an awe-struck face.

"Mein Gott in Himmel!" he ejaculated.

But this first phonograph was a very crude machine in comparison to the one we have now and Edison and his experimenting force worked over it for years before he could find a substance just suited for the making of a perfect cylinder.

"We started out using soft wax," said Edison, "but that was too soft. Then we tried every kind of wax that is made and every possible mixture of wax with hardening substances. We invented new waxes. There was something objectionable about all of them. Then somebody said something about soap. That worked better, but it wasn't what we wanted. I had seven men scouring India, China, Africa everywhere, for new vegetable bases for new soaps. After five years we got what we wanted, and worked out the records that we use to-day. They are made of

soap—too hard to wash with and unlike any other in use, but soap just the same."

THE ELECTRIC RAILROAD

The electric train such as is used on the New York Central Railroad now is not the least of Edison's gifts to the world. When Mr. Villard of the Northern Pacific Railroad asked Mr. Edison if he could invent some way of running that road by electricity, Edison replied: "Certainly, but it is too easy for me to undertake; you can get someone else to do it." "But I want you to tackle the problem," Mr. Villard insisted. Once at work, however, Edison threw himself into the project in his usual whole-souled way. He invented a scheme of a third rail and shoe, and erected it in the yard of his new home in Orange. One day Edison asked some mechanical engineers down to see the road in operation. He invited them to take a trip in his new engine. Not without reluctance the gentlemen mounted the cab of the queer little machine and Edison started off at full speed, up hill and down dale and around sharp curves at the rate of forty miles an hour. "When we go back, I am going to walk," remarked one of the visitors, trying to be casual. When the train gave an unusual lurch, one of the other gentlemen feebly protested at the rate of the speed over the sharp curves. Edison, absorbed and delighted in the engine, replied confidently, "No, no, it's all right. We've done it often." Just then the train gave an extra large bump, jumped the track, hurling all the occupants, save Edison, helter skelter in every direction. "Edison was off in a minute, jumping and laughing, and declaring it a most beautiful accident." His German assistant, Kruesi, his face cut and bleeding, regarded him woefully from where he sat in a clump of bushes. "Oh, yes, it is pairfeckly safe!" he remarked sarcastically. Fortunately no severe damage was done and in a few moments they had the train on the track again in running condition, but it is not recorded that the visitors rode back.

THE MASTER INVENTOR

So step by step Edison mounted up the ladder of invention until he became generally recognised as the "Modern Wizard." He made machines for the crushing and grinding down of mine ore; he entered the cement business and placed the finest, hardest cement in the world on the market, and conceived the idea of houses of cement poured into iron molds, which should be fireproof, waterproof and vermin proof, and all this at very moderate cost; he produced the motion-picture machine; he developed his wonderful Edison storage battery for street car propulsion. And these are but a few among the dozens of well-known inventions that have placed the world forever in the debt of this great Master Inventor. His influence in the development of the manufacturing interests of our country has been enormous. And what has been at the bottom of this man's marvellous success in whatsoever he undertakes? A strong body, a clear and active mind, a wide imagination, a capacity for great mental and physical concentration, an iron nervous system, intense optimism, courageous self-confidence and indomitable persistence.

"Edison moves among his complicated series of shops and experiments with such energy and yet such a seeming lack of order that he is the despair of all the men who try to analyse him. To see him moving through his great laboratories, head bowed, hands in pockets, his face set in an expression of intense mental preoccuption, his hair carelessly combed whichever way it may please it to fall, his eyes focussed miles away except when he flashes into someone else's a look of instant understanding, his whole appearance, except for the eyes and the humourous yet grim mouth, is that of a dreamer rather than a tireless worker."

"Nearly every man who develops a new idea," says Mr. Edison himself, "works it up to a point where it looks impossible, and then he gets discouraged. That's not the place to get discouraged, that's the place to get interested. I can't recall a single problem in my life, of any sort, that I ever started on that I didn't solve, or prove that I couldn't solve it. I never let up until I had done everything that I could think of, no matter how absurd it might seem."

THE ENGLISH GAME CROQUET

CONTINUED FROM 4354

EVERYONE knows the game of croquet as it is played in this country. The English game is played in the following manner. Along each of two parallel edges of the lawn we must mark off a length of thirty-five yards, and at right angles along each of the other two parallel edges of the lawn we must measure a length of twenty-eight yards, measuring this off, of course, from each end of the thirty-five-yards line. This will give us a rectangle, or oblong, thirty-five yards long by twenty-eight yards wide. At each of the four corners flags should be placed to mark the boundary.

Having marked out our playing space, we must now fix in the six hoops and two pegs used in the game. The simplest way of doing this is to find the centre of the twenty-eight-yards boundary by measuring fourteen yards along it from either flag, and from this point measure off a distance of seven yards into the playing space at right angles to the boundary. At the end of the seven yards place one of the two pegs—either the white or turning peg, or the coloured or winning peg.

Repeat this operation from the centre of the other twenty-eight-yards boundary with the remaining peg. From each peg, still continuing at right angles with the twenty-eight-yards boundaries, measure off another seven yards, and knock in a hoop at each of the two points. This will give us an imaginary centre line like the dotted line in the first diagram, thirty-five yards long, divided into five equal lengths of seven yards.

Starting from the white post and proceeding straight up to the coloured post we have: the white post, the first centre hoop, the second centre hoop, and the coloured post. We have now to decide the position of the corner hoops. From the white post we must measure off, right and left, a distance of seven yards parallel to the twenty-eight-yards boundary. A hoop must be placed at each of these two points. Then we repeat this from the coloured post, and our croquet lawn will be complete.

If a lawn is too small to allow a playing space of thirty-five yards by twenty-eight yards, we should mark off the space as large as the lawn will allow, keeping the proportions of five to four.

Our croquet set consists of four mallets, and each is marked with a coloured ring, corresponding to one of the four colours on the winning post.

One of the mallets is marked with blue, the second with red, the third with black, and the fourth with yellow.

Each of the mallets has a ball of a corresponding colour; the player using the blue mallet plays with the blue ball, and so on.

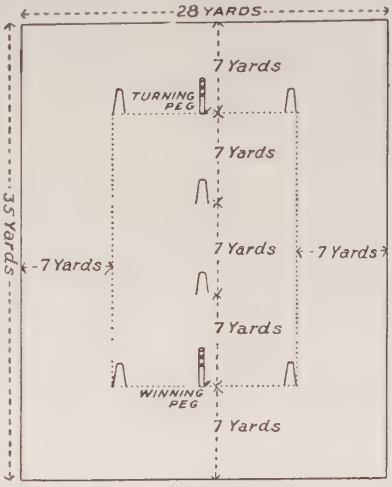
The game is played between two sides, each side, consisting of one or two players, taking alternate turns. That is to say, if there are four players the blue and black mallets shall be partners against the red and yellow mallets. The balls are played in the order marked on the coloured or winning post—blue first, red second, black third, yellow fourth. This means that partners never immediately follow each other. Partner and opponent play alternately, and this order must be retained throughout the game. Should there be only two players, one takes the red and yellow balls, and one the blue and black balls, playing the colours in the proper order. Three players may have very good fun by each taking one ball and playing his own game against the other two.

The starting hoop is the one on the left-hand side of the winning peg. In opening the game the player with the blue mallet, who always starts first, plays his ball directly in front of the starting

hoop, a mallet's length from it. He then knocks his ball through the hoop, and is followed in order by the red, black, and yellow balls.

Each player then proceeds as follows: He hits his ball down the field and through the corner hoop directly facing the starting point. He then proceeds at right angles across the field past the white post without hitting it, and through the third corner hoop. Then he hits his ball up the field and through the last corner hoop in line with the winning post.

Through this last corner hoop he proceeds to the middle of the field, through the two centre hoops, and down to the white or turning peg, which he hits. He then starts upon the second half of the course by turning to the left, making for the corner hoop which was the second hoop in the first half of the game. He then proceeds back through the hoop in reverse order to the first hoop, and finishes by coming up to the winning post through the two centre hoops.



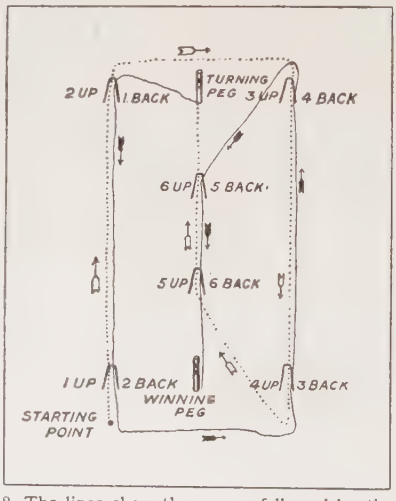
1. The croquet ground as it appears when laid out for a match, with pegs and hoops in position.

Diagram 2 shows the order of the hoops; the course to the white post being shown by a dotted line, and the course back to the winning post by a continuous line.

When there are two or four players, the winning side is that which gets both its balls home first. When three are playing, the winner, of course, is the player who hits the winning post first.

This is the bare outline of the game. The fun begins when we actually play, and find out how we can prevent our opponents from getting through or "running" their hoops, and how we can help our partners and assist ourselves at the expense of our opponents. It is this offensive and defensive play which makes the game so fascinating.

We must understand the following rules, however, before we can realise the full possibilities of this entertaining game.



2. The lines show the course followed by the players from starting point to winning peg.

When the player successfully runs his hoop, he is entitled to hit his ball a second time. If in taking this second stroke he hits another ball, this being termed a "roquet," he may "croquet" the ball he hits—that is, he may pick up his own ball, place it in any position touching the ball he has roqueted, and hit both his ball and the roqueted ball in any direction he desires. He then has another stroke, and if he roquets a second ball he may also croquet that, and so with the third ball. No ball must be roqueted twice before the player has made a point—that is, run a hoop or hit a peg. After a third roquet, therefore, the player proceeds down to his hoop or peg. If he fails to run the hoop or hit the peg, his turn is finished. Of course, he only roquets a ball when he thinks it is to his own advantage to do so. He may find it better to roquet no balls at all in some cases, in others to roquet one or two balls, and in others all three balls. If in running a hoop the ball hits another ball, the player who has made the point may at once croquet the ball, his one shot through the hoop counting as a roquet.

Each time the player makes a fresh point, he may roquet all the balls over again, continuing to do so as long as he makes his point regularly after every third roquet. If a player sends his ball beyond the boundary line marked by the flags, he must at once bring it back three feet inside the boundary. A player roqueting a ball beyond this three-feet limit may take his croquet, but if in doing so he sends the croqueted ball beyond the boundary, he forfeits the hit to which he is entitled after a croquet, and his turn is finished.

The roquet may be applied to our own benefit in a number of ways. For example, if our ball has rolled past a hoop without going through, we may still run it in one turn if we can roquet a ball, croquet it up in such a way as to leave our own ball in front of the hoop on the right side of it, so that we can run the hoop with the shot following the croquet.

In the same way we may croquet our partner's ball into position, being careful to remember that it is the croqueted ball and not the croqueting ball which must this time be left in position for running the hoop. If, however, neither our own ball nor that of our partner has run the hoop, it is possible to croquet both our partner's ball and our own into position with the one stroke. We should roquet our opponent away and leave ourselves in position to run a hoop.

HOW TO PLAY THE GAME OF CROQUET

The first picture shows the start, the drive to corner. The second and third pictures show how to make the forearm drive, when it is desired to keep the two balls together and make them travel for a good distance.

The first of these pictures shows how to hold the mallet and swing it back for the side stroke, and the second shows the finish of this stroke. The third picture shows how to make a hoop, and the fourth taking croquet near a hoop.

The first picture here shows making a croquet near a hoop. The second picture shows how to tap a ball sharply on the top to make it jump over another ball to go through the hoop, as shown by the dotted line in the third picture.

In the first picture the player is making a run in the croquet stroke; in the second she is moving away the opponent's black ball to the difficult position marked by the black dotted circle and putting her own white ball near the hoop, as shown in the white dotted circle; the third is pegging out the opponent's ball.

A SALT-WATER AQUARIUM

THERE are few hobbies more interesting than the keeping of an aquarium, and we read on page 4145 how to make and stock a fresh-water aquarium. We should always begin with fresh-water fish and plants, as these are much easier to manage than marine creatures; but when we have had some experience with them, we can go on to form a salt-water aquarium, and certainly we shall find this even more interesting and instructive than the other. The variety is greater, and the fact that we are dealing with creatures and plants that live in the mighty ocean, and the curious form and habits of some of the inmates of a marine aquarium, all lend a vivid interest to the hobby that even the fresh-water aquarium, interesting though it may be, does not possess.

HOW TO GET SEA-WATER

In these days it is easy to get real sea-water, if you live near the coast or in a city where men sell live fish. Of course, the actual sea-water is what we shall find best for our purpose. But it is not an absolute necessity, and if there is any real difficulty, we can make artificial sea-water that will do quite well for the aquarium, and will support marine life as effectively as real sea-water.

We can buy from most druggists sea-salt in little bags, and the druggist will tell us what proportion of the salt is required to a given quantity of water. Or, if it is not easy to obtain the sea-salt ready prepared, we can get the salts separately, and make our sea-water in this way. Dissolve in a gallon of fresh water—spring or rain water for preference—the following substances: Common table-salt, 3½ ounces, and Epsom salts, ¼ ounce, both avoirdupois weight, and chloride of magnesium, 200 grains, and chloride of potassium, 40 grains, both troy weight. There are, of course, other substances in real sea-water, but these form the principal ingredients, and are quite sufficient for our purpose.

RENEWING THE WATER

The water, of course, evaporates, and the very great mistake that many people make is to renew the stock with sea-water. But in the process of evaporation only distilled water is absorbed by the atmosphere, and the various salts are left in the tank. If we fill up the aquarium with salt water from time to time, the result will be not sea-water or its equivalent, but a dense and strong brine which would kill all living things in it. We replace the evaporated water with fresh water, and if we can get clean rain-water, all the better.

In filling the tank in the first place with sea-water, it is necessary to put a mark on the glass to show how far up the water comes, then, in renewing to make up for evaporation, we shall know exactly how much fresh water to pour in, because we should keep up the fluid always at the same level. A strip of stamp-paper, stuck on the tank to mark the height at which the water stood in the first place, will prevent us making mistakes.

SEAWEEDS FOR THE AQUARIUM

Before putting in our marine creatures, we should prepare the aquarium for their reception. When the vessel is ready, we can make in a suitable place a sheltered corner, with stones or pieces of rock, and, after filling with water, we must get some seaweeds, for these help to keep the water sweet and pure. The green varieties of seaweed are the easiest to keep in an aquarium. The way to get them living is to take a chisel and hammer and chip off a suitable piece of rock with the seaweed attached.

The weed known as green leaves is the best. The rock should be placed in position in the gravel at the bottom of the tank, and in a day or two sea-bubbles will be seen round the weed. This is a proof that the seaweed has adapted itself to its new conditions of life. There are many very attractive kinds of seaweed found round our coasts that would look well in an aquarium, but unfortunately they will not live in artificial conditions, and so cannot be considered.

SEA-ANEMONES AS PETS

The most interesting creatures for our marine aquarium are sea-anemones. They may be obtained at quite a cheap price at any naturalist's shop; but, if we live at the seaside, or have a friend there, we may get them from the boatmen or fishermen of the place when we are on a holiday. It is very good fun hunting for them in the rock-pools that are found at so many places on the coast.

Six or seven varieties may easily be kept; but the hardiest of all kinds is that known as the beadlet. They attach themselves to the stones, and appear quite happy in captivity. They seem always hungry, and a small anemone in an aquarium was once seen to swallow a quarter, which cut it in two, whereupon the bottom half of the creature grew a mouth for itself and became a complete anemone, to the great astonishment of the boy who owned the aquarium.

FISH FOR THE MARINE AQUARIUM

A few of the ordinary common periwinkles may be put in the aquarium, with one or two limpets. Shrimps or prawns, too, are very interesting creatures, and they lend a fine touch of brightness to the aquarium, for their eyes glow like phosphorus, and their transparent bodies are daintily tinged with various colours.

But we must not be tempted to put any crabs into our tank, for, interesting though they may seem, they are such brigands that nothing will be safe in the water where they are.

A very common mistake made by beginners with the marine aquarium is the placing of crabs with the other creatures; but the havoc wrought by the crabs soon becomes manifest. Of course, any creatures that die, whether they be anemones, shrimps, or any other, must be removed at once, to save the water from becoming impure, owing to the decomposition of the body, which would soon be fatal to the other inmates.

Owing to the limited space which, of necessity, any private aquarium must furnish, there are not a great number of fish found round our coasts that are suitable for captivity in a tank. We cannot keep anything very large. Young sea-bass and herrings, and quaint sea-robins, do nicely. It is often possible in cities to get small live fish of various interesting sorts at fish-dealers' stores; but one who lives by the sea can get them himself from the tide-pools. The quaintest of all our seaside fishes are the pipefishes and sea-horses, which are not scaly, but encased in an armour which is almost bony, and have mouths more like a bird's beak than a fish's lips. As to feeding these creatures, they will eat shrimps or other small sea creatures, and the anemones can be fed upon pieces of meat.

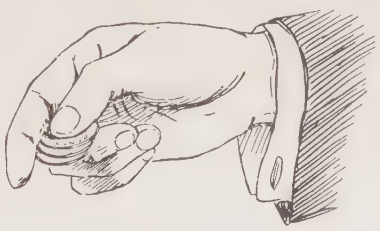
DANGERS OF OVERCROWDING

We must be very careful in starting a marine aquarium not to overstock the tank. Its capacity for fish and other creatures depends, of course, upon its size; but it is far better to have a few inmates than too many. Probably more disappointments occur through the error of overcrowding than through any other mistake that beginners make. All the rules as to cleanliness, keeping from direct sunlight, and other instructions, we may read on page 4145 in connection with the fresh-water aquarium.

TRICKS WITH ENGLISH PENNIES

THE "electric penny" is a very remarkable coin, and, skilfully used, will puzzle even persons who think that they know all that there is to be known about conjuring. We shall first describe the effect of the trick for which it was specially designed, and then we shall learn how it is done.

We offer to show a trick with three pennies, but, on searching our pockets, find —or profess to find—that we have one only, so we borrow two more, and lay all three in a row on the table. We pick them up one by one, and hold them, ranged one upon the other, between the thumb and second finger of the right hand, the lower coin projecting a little beyond the middle one, and the middle one beyond the top one, forming "steps," as shown in the picture, so that there can be no doubt that all three are really there. We announce that we are going to pass one of them through the table. Placing the left hand beneath, we drop the three coins, with a quick downward jerk, on the table-top, and bring the hand down flat over them. When we again lift our hand, two coins only are to be seen; and, bringing up the left hand, we produce the third penny from underneath the table.



The correct way to hold the coins

The secret lies in the peculiar construction of the "electric penny." This is a genuine coin, but "doctored" in a very ingenious way. We need hardly say that there is no "electricity" about it, but it has been cut in half, or nearly half, by a skilled workman, and the two parts have been joined together again with tiny spring hinges made of india-rubber. The two halves may therefore be folded together like the leaves of a book, but the moment the pressure on them is removed they fly open again, and the coin becomes flat as before. The workmanship in the case of a well-made coin is perfect, so that its appearance is unaltered by the cutting, and no one, unless permitted actually to handle it, would perceive that there was anything unusual about it.

Knowing the construction of the coin, we shall now have no difficulty in understanding the working of the trick. When laying the three coins on the table at the outset, we place the prepared penny at the right-hand end of the row.

In picking them up again, we begin at the opposite end. Taking the first coin, we lay it on the second and third fingers of the left hand, the tips of the fingers projecting a little beyond it. On this we lay the second borrowed penny, and on this again our own, with its *smaller* part towards the right hand. We then take, apparently, the three coins in the last-mentioned hand. In reality, however, the moment this hand touches the coins it folds down the smaller half of the prepared coin, and takes only this penny and the next one below it.

The third penny, unknown to the spectators, remains in the left hand, which holds it secure by slightly contracting the fingers on which it lies. When the two coins are dropped on the table, the spring coin resumes its normal appearance; and, as the third coin is already in the left hand, there is not much difficulty in producing it.

The young conjurer should be warned that this trick, though by no means difficult of execution, requires a considerable amount of practice in order to perform it with ease and certainty. On the other hand, it is such a good trick that it is a pity to spoil it by clumsy presentation. The cost of the "electric penny" is a few cents.

An expert in conjuring will find many other ways of using it apart from the trick we have just described. For instance, we may take a piece of cardboard six inches square, and in the centre of it cut a round hole, the size of a shilling. We lay this over the mouth of a tumbler, and say that we shall pass a penny through the hole.

We bring the mechanical penny over the hole in the card, and make a quick downward movement, at the same time folding the coin vertically between the thumb and fingers, when it will pass through and fall into the glass. The moment it has done so it unfolds, and again looks like an ordinary penny.

THE RIGHT WAY TO CLEAN THINGS

THERE is a right way and a wrong way of doing everything. From time to time many things require cleaning; our clothes may become spotted with grease, our fountain-pen may get stopped up, or perhaps we may have been cycling in the rain, and so have smothered our cycle with mud. When anything like this requires attention, the best thing is to clean the article without delay. On this page we are told the right way of cleaning several things that are in everyday use, and if we follow the directions given we shall save both time and trouble.

TO CLEAN STAINED CLOTHES

Before being brushed with a clothes-brush, dusty or muddy garments should be well shaken out of doors. It is better to let splashes of mud dry on cloth, and then remove them with a hard brush, always brushing the way of the nap. To rub the splash with a piece of the material itself before applying the brush is a good plan. A grease-spot can sometimes be taken out of cloth or silk with a few drops of eau-de-Cologne; and when grease is dried on cotton or woollen material, it may be removed by moistening it with warm water and soaping it. Benzine is also a good grease-remover.

Another method is to place a piece of blotting-paper or porous brown paper over the spot and press a hot iron on it, moving the paper every now and then until the grease is completely absorbed. Black cloth is freshened by sponging with cold tea or ammonia diluted with water. Lay the cloth flat on a table and sponge very carefully, moistening the sponge every now and then, and hang the cloth in the air to dry. Dirt-marks can be removed by rubbing them with rag dipped in gasoline, but this fluid must not be used near a light. Ink-spots can be removed by rubbing with milk or salt. This must be done at once, otherwise the application is of no use. If the ink-spots are old, the best method is to soap them and then lay a little salts of lemon or salts of sorrel on them; but the salts must not be rubbed in, or perhaps a hole may be made in the material.

TO CLEAN TOOLS

Every tool should have its place in the tool-chest, so that its edge is not blunted by knocking against other tools. Fine tools can be rolled up in flannel to keep them bright and free from rust. Any tool can be protected from rust by greasing it; but should rust attack it we must rub it off with emery-paper.

TO CLEAN KNIVES

We can clean a dirty, greasy knife by running the blade into mould slantwise several times and wiping it with newspaper. Table-knives are cleaned in a knife-machine, or by sprinkling emery-powder on a knife-board and rubbing the blade sideways horizontally along this so that the edge of the blade is not blunted.

TO CLEAN A FOUNTAIN-PEN

A fountain-pen is liable to get clogged with dried ink and hairs from the writing-paper and pen-wiper. If the pen has a movable point section, we can unscrew it, and let cold water from a tap run through it. The pressure of the water is sufficiently strong to cleanse this part, even through a small opening. The barrel will stand a strong pressure of cold water. It is important to keep the india-rubber bulb and glass dropper rinsed out with cold water after "feeding" the pen, otherwise the ink dries in the bulb and spoils it. If our fountain-pen is a self-filling one, we can clean it properly by filling it with cold water several times and then emptying it.

TO CLEAN PAINT

Dirty painted wood should be first dusted with a dry cloth, and then washed with a soaped one. Very hot water and a hard brush spoils the paint and takes it off. We must then rinse the surface with clean water, and dry with a soft cloth.

We can remove paint from brushes by dipping them in linseed oil or turpentine, and washing them in soap and water in the palm of the hand. The soap must be rinsed out in fresh water, and the bristles shaped to a point before being stood upright to dry.

TO CLEAN DIRTY WET SHOES

If the shoes are very muddy, the mud can be wiped off with a damp cloth; cakes of it may be removed with a knife, but this needs skilful doing, lest the leather be accidentally cut. Wet shoes should not be dried before a fierce fire, for great heat impoverishes the leather. It is better to place them on their sides in a room or passage where there is a good draught. When dry, any remaining dirt can be brushed off before the shoes are blacked in the usual way for cleaning.

TO CLEAN A BICYCLE

When the bicycle is brought home wet and muddy, we should wipe the spokes and enamelled parts with a cloth. Kerosene will clean the chain, and one of the numerous metal polishes will clean the nickelled parts. The chain may be brushed over with graphite or some preparation containing blacklead. Tires must be wiped clean with a wet house-flannel. The best way to clean the bearings is to run kerosene through them until the dirt has been washed out, and then to apply lubricating oil.

TO CLEAN A SPONGE

Sponges are likely to become disagreeable and slimy if used long without being cleaned. This can be done by washing the sponge in ammonia and hot water, and then leaving it for some hours to soak in cold water in which some coarse salt has been dissolved. Soaking in sea-water, its native element, freshens up a sponge. A coarse cloth is better than a sponge for the bath.

TO CLEAN BOTTLES

A glass bottle can be cleaned inside in many different ways. One way is to pour some household ammonia into it, shake it well, empty it, and rinse it clean with warm water. If the neck be wide, small pieces of a raw potato mixed with salt and water can be shaken up in the bottle, or we may use tea-leaves.

DOLLS MADE FROM CLOTHES-PINS

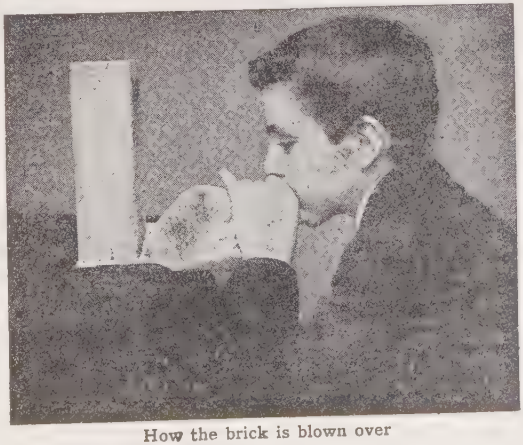
THE common, round clothes-pin is a convenient article to adapt so as to make tiny dolls or figures. The split end serves for legs, and the body and head are all there ready made, so that the work is simple and easy. Then clothes-pins are cheap, so that we can use a good many of them without incurring much expense, and that fact is an important consideration if we have not much pocket-money. If we prefer it, instead of making dolls we may make a small army of soldiers. A clothes-pin will not stand steadily on its legs, so we must therefore provide supports by which our dolls or soldiers may stand upright. These supports may be small pieces of cardboard, or thin wood or cork, about the size of a quarter, as seen in the pictures. A tack or two driven through the support into the bottom of the legs will serve the purpose.

Four little dolls made from clothes-pins

Then there are many ways in which we can decorate or dress our clothes-pins, so as to make them look realistic. Black ink is the plainest form of decoration we can apply, and the first two pictures show clothes-pins finished in this way. One is a circus clown and the other is a negro with a fool's cap, which is made from a piece of paper twisted into shape. If we wish to give colour to some of our dolls, we can easily do so by using our box of paints, and there is room for a display of skill even in such a simple thing as this. If we begin to put dresses on our clothes-pins, tissue-paper is at once the cheapest and easiest material to work. In pictures 3 and 4 we see a man and a woman clothes-pin dressed in tissue-paper. They look quite handsome if the work is neatly done. The man has a tall hat, which is made from a cork stuck upon the head. There are many other varieties of dress that will suggest themselves as we experiment with the pins, and it is always better to devise different styles than to copy something exactly as before. On page 934 we see how to make a pair of wrestlers from two clothes-pins, and, if we have not yet done this, we can do so after we have made a few trials with simpler figures to get used to the work.

BLOWING A BRICK OVER ON A TABLE

SUPPOSE that we put a brick on the table and make it stand up on end, then, simply by using our breath, we try to blow it over. Of course, we shall fail. The idea of blowing a brick over seems ridiculous. But, after all, it may not be so ridiculous as it seems. Indeed, there is a way by which we can make a brick fall over simply by blowing with the mouth. All we have to do is to procure a paper bag of fairly large size, such as fruit-sellers and bakers use to wrap things in; then we set the brick, end up, on the bag near the bottom end, and, after gathering the mouth of the bag together in one hand, we blow into it sharply, as is being done in the picture, when the brick will be blown over on its side. Of course, anything else of convenient shape, such as a large, heavy book, can be blown over in the same way. This trick is very good for an evening party, and it can be performed by a girl or a boy.



How the brick is blown over

We can mystify our friends by placing the brick upon the table and then talking of the wonderful power of the wind, telling of the enormous damage it does in a storm. From this we should lead up gently to the power of the lungs, and then announce that it is possible to blow over the brick upon the table. Our friends will naturally doubt this fact; but we must persuade them to try. When they have tried and failed, we just take a paper bag and show the company present how it is done.

KEEPING GUINEA-PIGS AS PETS

GUINEA-PIGS are always very interesting pets for boys and girls to keep. The proper name of the clean little pet that we know as the guinea-pig is the cavy. But we seldom speak of cavies, and nearly always of guinea-pigs. It is difficult to understand how the name of guinea-pig came to be applied to the animal. It never at any time came from Guinea, which is in Africa, nor from New Guinea, the large island north of Australia. Also it is singularly unlike a pig.

The sort of hutch that serves to keep rabbits will do equally well for guinea-pigs. Their manner of life and the food that appeals to them are very much the same. On page 452 we read how to keep rabbits, and if we turn to page 454 we shall read how to make a hutch for guinea-pigs.

Rabbits and guinea-pigs are often kept together and do very well, but we may as well know that the reason some people give for keeping guinea-pigs with rabbits is based on an entirely false impression. It is supposed that guinea-pigs keep rats away from the rabbit-hutch, and many boys know from sad experience that rats do not hesitate to eat very young rabbits if they get the chance. But there is no truth in the belief that guinea-pigs keep rats away.

Guinea-pigs may be purchased from any dealer in animal pets. The price paid for an ordinary short-haired pair is usually about a half dollar, or even less. Fancy guinea-pigs, such as the long-haired Peruvian breed, cost, as a rule, four or five times as much. The hut or hutch in which the pets are to stay should be warm and dry, just as for rabbits, and there should be plenty of warm bedding, such as dry hay, which should be renewed frequently, so as to keep the little house sweet and clean. The animals are very clean themselves, and the hutch should be cleaned out regularly every day. The dishes from which they feed should be washed every morning, and all scraps of food that remain uneaten should be taken away at the same time. They should also be provided with a dish of clean water.

The food of the guinea-pig is similar to that of the rabbit. They eat dandelions and fresh vegetables, roots, such as carrots and turnips, and they like bread and milk. We should give them as much food as they can eat, but if we find that they eat every particle of food that we give them, we may conclude that we have not been giving enough.

Guinea-pigs begin to have young very early, when about two months old. The young ones come in litters of three to five, and one father and mother may have about five litters in a year. It has been calculated that under the most favourable conditions one pair of guinea-pigs might increase to about a thousand in a single year.

When the young guinea-pigs come, they are pretty little creatures, well covered with fur, and with open eyes. They begin to eat the same food as their father and mother the day after they are born, and in about two months they may have young of their own. In winter the hutch with the guinea-pigs should be placed indoors, and care in regard to feeding, and attention in regard to cleaning, should never be slackened.

SOLUTIONS OF THE PUZZLE RHYMES ON PAGE 4351

SOME puzzles, rhymes, and verses are given on page 4351, to which these are the answers.

The word referred to in the first verse is cataract, which is certainly a fine sight when found in the course of a river like the Nile, but is anything but pleasant as a defect of sight. The solution of the next rhyming puzzle is anemone, an *m* on *e*.

Dr. Whewell's strange-looking puzzle can be solved by remembering that O is a cipher. The lines can be read like this :

You sigh for a cipher, O I sigh for you,
Sigh for no cipher, O sigh for me too.
You sigh for a cipher, I decipher so,
I sigh for no cipher, I sigh for you too !

Of the buried names, the animals in the first verse are : chamois, buffalo, heifer, and leopard ; the eight British poets in the next verse are : Gray, Moore, Byron, Pope, Dryden, Gay, Keats, and Hemans ; and the four fruits in the last verse are : orange, pear, date, and banana. These can all be traced easily.

The solution of the first arithmetical puzzle is written thus : $\frac{9}{6}\frac{6}{9} = 16$. Two of the three nines are put upside down. In the next puzzle the answer can be given in rhyme :

Forty-five years I had seen,
When my bride was but fifteen.

This, it will be found, answers the requirements of the puzzle rhyme. In the third arithmetical problem the solution is worked out in this way. The two nines are written thus : IX NINE. Then S, which is a third of SIX, is written at the beginning and at the end, and we have SIX NINES, which is equal to 54. In the next puzzle the ages of the father and son are 42 and 14.

The answer to the first riddle in rhyme is POE, POET, POETRY. The T and TRY are added to the name of the American poet Poe. The thing "often talked of, never seen, ever coming, never been," and so on, is to-morrow.

The solution to the first charade is OX, ox ; of the second CO, NUN, DRUM, conundrum ; and of the third WEL, COME, welcome.

ANSWERS TO THE CHARACTER GAME ON PAGE 4350

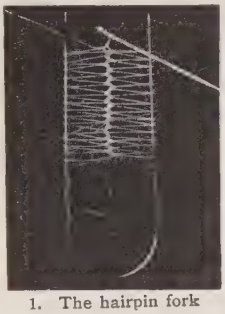
ON page 4350 are some descriptions of well-known characters who are mentioned in THE CHILDREN'S ENCYCLOPÆDIA, and we have to guess their names from the descriptions given. These are the men and women referred to : 1. St. Francis of Assisi ; 2. Oliver Cromwell ; 3. Shylock ; 4. Joan of Arc ; 5. David; 6. Miss Florence Nightingale.

A DOYLEY MADE OF HAIRPIN WORK

THE lacy-looking doyley seen in the picture may appear difficult to work, but it is really quite simple when the secret of making hairpin crochet gimp is understood. The doyley shown is indeed a first attempt at hairpin work.

The things necessary for making it are a ball of crochet cotton, size 20, a doyley centre, a crochet hook, and two metal hairpin forks, each costing a nickel. A steel crochet hook, size No. 3, should be used. If we do not understand crochet work, we should turn to page 1348.

If we intended to do very fine work, we might use a straight wire hairpin; but as it would be unwise to attempt any but fairly coarse gimp at first, we should buy two "hairpin forks," as they are called, one with a span of three-quarters of an inch between the prongs, the other with one and a half inches. The larger one is for making the wide gimp seen in the picture on either side of the narrow gimp, which is made with the smaller hairpin.



1. The hairpin fork

First, we set about making the wide gimp. About two inches from the end of the cotton, tie a loop in it three-quarters of an inch long, just half the span of the fork. Then, taking the hairpin in the left hand, prongs upward, we put the loop over the right-hand prong. Now, with the long cotton lying over the fingers of the left hand, we turn the fork round, so that the cotton encircles the left prong. To secure it, so that it forms a loop round that left prong, we take the crochet hook and draw the cotton forwards from behind, through the loop already made on the prong now to the left, and make a chain stitch. Then we lift the handle of the hook over the prong on the right while turning the hairpin.

2. The doyley as it appears when finished

Next, we make a double stitch through the front part of the loop on the left. After that we turn the hairpin and draw the cotton through the loop in the hook. And we proceed like this: (1) Make a double stitch through the loop on the left—see picture 1. (2) Turn the hairpin while lifting the crochet hook over the prong. (3) Draw the cotton carefully through the loop. We continue in this way, working between the prongs, until the hairpin can hold no more loops, and we have to withdraw it.

We must take care to pick up the last two or three loops on to the prongs again to form a foundation for another hairpinful. The loops should not be so tight as to draw the points of the prongs together, for then the loops of the gimp would get smaller. To judge the quantity of gimp required, we lay it round the doyley centre until we find enough has been made for the inner ring, and then fasten off the cotton by drawing it through the last loop and pulling it tight. The doyley centre may need a chain of crochet worked round it to make a foundation for the loops of gimp. This was done in the case of the doyley that is shown in picture 2. A row of chain is worked round that, each stitch being taken through a loop of the gimp. Some people put a circle of feather-stitch near the edge of the doyley centre. It is best to tie and join the centres of the ends of gimp with needle and thread and cut off loose ends.

We next make, on the smaller hairpin, enough gimp to go round the doyley. The loops of the two gimps are joined with chain stitch. Two large loops are taken into a chain stitch, then three chain crocheted, then two small loops taken into a stitch, and again three chain stitches follow. This is repeated till all the loops are crocheted in.

We shall now want a longer piece of the large gimp to go outside the small one. To this it is joined by crocheting three chain, then twelve chain, each through a loop of the large gimp. These twelve chain are joined into a circle by drawing the cotton through the first of them. We next make three chain, and follow that by taking two chain through two loops of the small gimp; then three chain, then two chain through two large loops; then three chain, then two chain through two small loops. These stitches are repeated until the circle is completed.

It will be seen that "doubling back" on the twelfth stitch forms a kind of scallop and

gives fulness like a frill. This part requires special care in counting the number of stitches.

At present the outer loops of the large gimp form a looped fringe. To give the doyley a neat edging we join the loose loops by crocheting three chain, then a chain through a loop, and repeat this until we come to the dip between the scallops, where the two loops are together on the opposite side of the gimp. At this point we make four chain, each stitch through a loop, then draw the cotton through the first of these four chain to make a small scallop, and proceed three chain and a chain through a loop until the next dip is reached. This we repeat until the loops are used up.

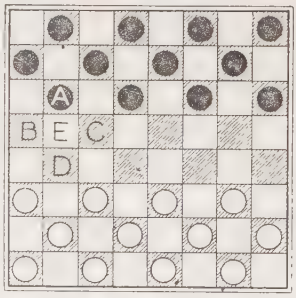
Lastly, to make the points to the edging seen in the picture, we start a chain through the middle stitch of three; make six chain; take a chain through the fourth one back to make the point; make two chain; then make one chain through the middle stitch of the three chain below. This is repeated all round the doyley, giving it a durable edge, so that it can be used for a cake-dish, and will stand washing well. With a little ingenuity, pretty designs for embroidery work can be made with hairpin gimp. Treble stitch can be substituted for double stitch, and gives a solid, broad centre to it. This effect is increased by working three treble stitches into each loop.

Wool, macramé twine, silk, in fact, any thread used for crochet, will make hairpin gimp. Done in peri-lusta the gimp makes a foundation for pretty insertions and laces of various kinds. Bags, purses, shawls, and other articles can be made with hairpin gimp.

HOW TO PLAY DRAUGHTS, OR CHECKERS

THE ordinary game of checkers, unlike most amusements, is so simple that a child can learn to play it, and yet it lends itself to such careful study that men play it almost as they play chess, looking many moves ahead, and making the most wonderful combinations.

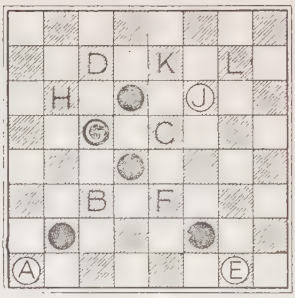
The board has 64 squares, 32 of one colour, as, for example, white, and 32 of another colour, such as black. There are 24 men, discs of wood or bone, 12 white and 12 black. Each player takes one of the sets of men and arranges them as in the first picture, taking care that there is a white square at the bottom right-hand corner of the board before him.



The pieces are placed on the black squares to start with, and are always played on these squares, never being moved on to the white. They are moved diagonally, that is, the man A in the picture will move to B or C, but will not leap across the white square E to D. They move forward, one square at a time, the players taking turns alternately. A man is captured by the opponent's piece leaping over him diagonally into a vacant square beyond, and the captured man is then removed from the board.

If, after leaping across an opponent's man into the next square beyond, we come next to another of our opponent's pieces with a vacant square beyond that, in either direction, we can continue our move and leap over this second piece, taking that as well as the first one. Even more men can be captured at a single move, provided each one has behind him a vacant square into which our piece can be moved.

The second picture, which is a game in course of being played, will explain the moves clearly. We can move from A to B, then to C and then to D at one move, taking three of the black pieces on the way. But from E we could move only to F; we could not go to G because it is occupied by a black piece, and we cannot leap across two pieces together and go to H. When we are not capturing the men, we move only to the next square. The white man J, for instance, in picture 2, can move only to K or L.



As soon as a man has reached one of the four squares at the opposite end of the board, he is crowned, that is, has another draught put on top of him, and becomes a king. He can now move either backwards or forwards on the board. This is a great advantage, and sometimes five or six men may be captured by a king at one move. The object of the game is to take all our opponent's men, or so block them up that they cannot move, then we have won. When an opponent is able to take one of our men, and does not do so, we can either huff him—that is, take from the board the man with which he could have captured our piece—or we can compel him to make this move in preference to the one he has taken. Huffing does not count as our move. The choice of colour is decided by lot, and black moves first. In each fresh game we change our men, playing first with black and then with white, and so on. If we touch a man, we must move that man. If we remove one of our own men from the board by mistake, we have to lose it. Usually when only two kings remain on the board a deadlock occurs, and there is no way of either player winning, except by the gross carelessness of the other; therefore, with only two kings on the board, the game is drawn.

MUSIC FROM DRINKING GLASSES

When we consider that music really consists of regular wave movements passing through air or some other medium, it does not surprise us to find that if we can make sound waves vibrate through a substance like glass, we hear a musical note. Musical instruments are played by striking, plucking, rubbing, or blowing; and we can get a musical note out of a tumbler by tapping it or by rubbing it. When we rub the strings of a violin with a bow, we make the strings vibrate; and the vibrations pass off into the air in all directions, some of them reaching the drums inside our ears.

It is possible to see with our eyes how wave movement and sound are connected with each other. If we get a thin goblet or wine-glass and tap it gently with the thumb-nail or with the back of a knife, it gives out a sound that is a clear note, and which we can name by finding another like it on the piano. Now we will place the glass on a table, fill it nearly to the top with water, and hold the stem of it steady with the left hand. Then, if we moisten the second finger of the right hand with water, and rub it steadily round the rim of the glass, we shall find before long that the surface of the water is in commotion, striking the sides of the glass and giving out a clear, bell-like note.

Long ago—some people think it was in the time of the ancient Egyptians, who used to make beautiful glass—someone found out that sweet notes could be obtained in this way from the rim of a glass vessel, and started experimenting. Thus the idea of playing musical glasses arose, and very beautiful music they give. For some 150 years people have enjoyed this music in Europe.

We can collect our own musical glasses; but we must make a diligent search for them, for not every glass has a true note any more than every person has a sweet voice. Ordinary drinking glasses will do, but they must be thin. Two such glasses may be made just alike, but when they are tested, as described above, by tapping with a thumb-nail or with the back of a knife, their pitch, or note, will be found quite different.

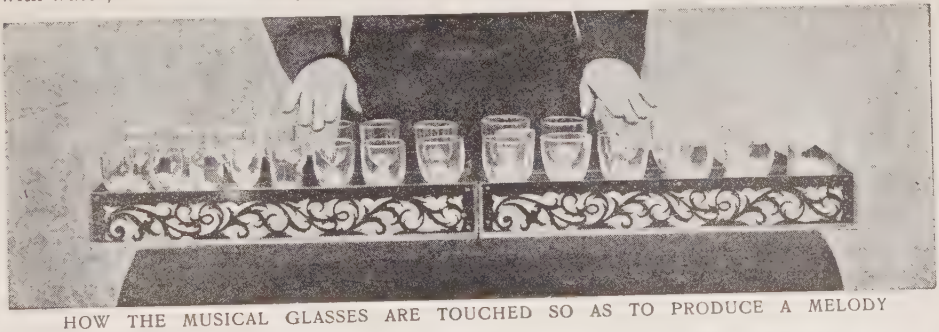
Suppose we want a glass which gives the note F, we shall possibly have to test a dozen or more glasses before we find one that gives a note anywhere near it. But even if it is not quite in tune, a little water poured into the glass will make the note lower, or lower the pitch. The reason for this is, the greater the number of vibrations per second, the higher is the pitch of the note. So we see that the water poured into the glass acts as a sort of brake on the vibrations, which have to move more slowly, and, in consequence, we get a lower note.

If we mean to have a complete set of glasses, we shall need quite thirty-three, or just over two and a half chromatic octaves of tones and semitones. This makes a "manual," such as is seen in the picture, where it will be noticed that the glasses are of different forms and sizes, placed in order in wooden trays, with partitions to steady them. One advantage in playing on glasses is that we can place the notes of the scale in the order we prefer; and though we play with both hands at once, it is more convenient for a left-handed person to be able to place the notes most used under his left hand instead of under his right, as right-handed people have them.

Before attempting to touch the glasses, we must be sure that the fingers are quite clean; and, in order to harden their tips somewhat, and to improve our touch, we may dip them in a glass of water into which a few drops of lemon-juice have been poured. Then we gently and firmly rub the second finger of the right hand round the rims of the glasses in the same direction as the hands of a clock, and test all the glasses, going up the scale. At first the notes will come slowly, but with practice we shall get true, pure notes. Then we may try to pick out a tune. "The Bluebells of Scotland" or "Home, Sweet Home" are found as easily as any. As both hands can play, while one is still touching a glass, we can find the succeeding note with the other hand.

After a time, players get expert in using both hands at once, so that they can employ them in unison or in part harmony. A skilful performer starts one note before the last one has died away, and so makes delightful harmonies. With two or three sets of glasses, it is possible to play duets or trios.

Our musical glasses are very easily tuned, not that they really *need* tuning like a violin or a piano. All we have to do is to add a little water to the glass or else take some away from it, and so raise or lower the pitch.



HOW THE MUSICAL GLASSES ARE TOUCHED SO AS TO PRODUCE A MELODY

A LITTLE VEGETABLE GARDEN

WHAT TO DO AT THE END OF OCTOBER

If we have not already made the soil suitable to receive any fruit-trees we might think of planting during the autumn, we should do so now. The work of planting can be done late in October or early in November.

We may well take great care with the actual planting of our currant-bushes or gooseberry-bushes, or whatever we may contemplate planting, as upon this depends much of their success. First of all we must bear in mind that the hole must not be too small. It does not need to be very deep, but it should be a *large* hole with a flat bottom, and the soil should have been worked and stirred a good deal deeper than the hole has to be, so that the roots may get to work quickly.

When the hole has been made ready, we take our bush and, holding it upright in the hole, spread out the roots on all sides; if there is not ample room for all these roots to lie outspread quite comfortably, we must widen the hole, as it is the placing of the roots fairly and squarely, as it were, that makes all the difference between good and careless planting.

It is best for one young gardener to hold the bush in position, and for a second one to shovel in the soil about it. This soil needs to be firmly placed about the bush, and to be carefully trodden down, for we have to remember that high winds and sharp, penetrating frosts are before us, and that the soil must therefore be so firm that our bush does not become loosened. To prevent such an occurrence, it will be well to examine the stems of the bushes during the winter from time to time to see that all is right, and especially when a thaw follows a long spell of frost.

Gardeners must always remember that, whatever crop they grow, they are taking the goodness from the soil, and that on this account they must frequently give back to it what has been taken out. We do this when we put manure into the soil, or when we dig in well-decayed leaf-mould. This brings us to an important point. Now that the leaves of the trees are falling, we have at hand valuable material, and on no account should we neglect to sweep up all dead leaves and make them into a great heap.

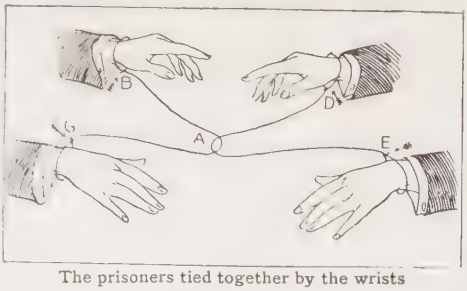
It will take a long time for this heap to decay and become the valuable leaf-mould that proves so useful; but, if we have patience, in time our leaf-mould will be produced, and we can hasten matters somewhat by mixing lime with the leaves and turning them over from time to time.

This is the time to make any alterations in the plan of our little gardens; we may build rock-gardens or make ferneries, and we may make new pathways or new beds and borders.

We may plant rose-trees or fruit-trees, and move our flowering plants. We may plant bulbs. We may lift, with plenty of soil, some plants of parsley, and plant these in a frame for winter use. If we have roses growing in pots, these may still stand out in the open — even up to November — but really tender plants should not be left out of doors after the first of October, though dahlias and gladioli and tuberoses need not be lifted from the soil until a sharp frost comes along and kills their foliage.

TYING TWO PEOPLE TOGETHER

A very amusing and perplexing trick may be played at an evening party, in which the only apparatus needed is a piece of string, that should be divided into two parts, each about a yard in length. Two of the guests are asked to come forward, and the pieces of string are tied upon their wrists in the manner shown in the picture, so that they are fastened together. What they have to do is to release themselves from one another without untying the string at any place.



The prisoners tied together by the wrists

If the two who have been tied together in this way do not know the trick, they will either very soon give it up, or they will get themselves, in a short while, into a helpless tangle. Yet it is quite simple to effect a release under the conditions named when we know the trick.

The secret is as follows: Take the string at the point A, and, making a loop, pass it through the loop on the wrist at B in the direction of the arrow. Then pass it over the hand, and the prisoners will find that they are no longer bound together, but can go free. Of course, the loop at A can be passed through the loop on the wrist at C and over that hand, and the result will be the same. Or, making the loop in the other string, we can pass it through the loops at D or E, and the partners will be loosed. This is a trick the unravelling of which is not confined to the two persons who are tied together. When they have tried to free themselves and failed, or if they know the trick, the other members of the party may be invited to release the partners. When the release has been effected, by reversing the process the prisoners may be joined up again. In trying this trick we must be careful to put the string at A through the loop on any of the wrists in the direction pointed by the arrows, or the release will not be effected.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 4561

THE DAYS WE CELEBRATE

WHAT is a legal holiday? Almost every boy and girl will answer, "It is a day when all the schools and shops are closed and we don't have to work, and can have a good time." Yes, assuredly, a holiday is a day for having a "good time." But how many of you who hail Washington's Birthday and the Fourth of July and Thanksgiving Day so joyously ever stop to think of the real significance of the events which these holidays commemorate?

Such holidays are the memorial stones raised along the path by which a nation rose to greatness. Every country has its special days set apart from the routine work of the year in memory of some great man or great event in the nation's history or for the performance of some public duty to the State. England has Empire Day, Victoria Day, Dominion Day, Guy Fawkes Day and many others. The United States celebrates the Discovery of America, the Landing of the Pilgrims, Thanksgiving Day, Washington's Birthday, Flag Raising Day, Independence Day, Lincoln's Birthday and (in the South) Jefferson Davis' and Lee's birthdays; Election Day, Arbor Day, Labor Day and several others in different States.

MEN WHO HAVE HELPED TO MAKE OUR UNION GREAT. CHRISTOPHER COLUMBUS. DISCOVERY DAY, OCTOBER 12, 1492

It was the unswerving determination and courage of one man — Christopher Columbus, an Italian by birth — that first brought the great continent, on which our nation was to rise, to the attention of Christian Europe.

Columbus believed that the world was round and that by sailing due west, he would at last come to the northern part of Japan (the East Indies) and thus open a new route to the East Indies, the land of pearls and silks and spices.

Many thought that Columbus was mad, and everywhere men were too busy to listen to the plans of the "visionary dreamer," as they called him. So poor Columbus wandered from court to court of Europe, trying in vain to procure financial backing for his scheme, until he came to Spain. Here Queen Isabella became interested in his plan and Columbus was supplied with three ships for his voyage of exploration. (See page 2367.)

The difficulties that Columbus faced on that first voyage can never be truly known. In a strange sea, with rough weather and a mutinous, terror-struck crew, it was only the indomitable purpose of the man that kept them on their westward course. Daily the sailors implored him to turn his ships toward home. They swore that they were in a haunted sea and a thousand unknown terrors dogged their footsteps.

"I will not turn back till, with the help of God, I find that land," Columbus said. (See page 567.)

At last one morning a cry went up from the ships. Land was in sight! It was the Island of San Salvador in the Caribbean Sea. Thinking that he was near India, Columbus called the islands the West Indies.

Columbus made four voyages to the West and attempted to found Spanish colonies, but with little success. Courageous as his spirit was, he was ill from exposure in a foreign climate and he could not control the rough adventurers who came out to settle the colonies. Malcontents were continually returning to Spain to make trouble for him at court. They reported that he was mismanaging the colonies, treating the Indians badly, and taking the riches of the new land for his own use.

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Much worried by these stories, Queen Isabella sent out a governor to inquire into matters. The new governor was jealous of Columbus and, landing with the authority of the Spanish sovereigns, he promptly threw him into prison and presently sent him home *in chains*. The proud heart of Columbus was almost broken. He went before King Ferdinand and Queen Isabella a grey, bent old man, the story of his misfortunes written on his face.

The king and queen were indignant at the treatment their faithful servant had received, and promised him four more ships for another voyage of exploration. On this last voyage Columbus sailed as far as the Isthmus of Darien, but his ships rapidly became so unseaworthy that he hastily turned them toward Hayti. They were unable to get further than Jamaica where they remained stranded, waiting for help which the governor refused to send for nearly a year.

Soon after Columbus returned to Spain, his good friend, Queen Isabella, died, and King Ferdinand, absorbed in affairs of state, made no attempt to reward the old man for his years of faithful service to the crown, and presently he died in poverty, neglected by the country he had tried so faithfully to serve.

Four hundred years later the President of the great nation which had risen on the land discovered by Christopher Columbus made the following recommendation to the people of the United States:

"Now, therefore, I, Benjamin Harrison, President of the United States of America, in pursuance of the aforesaid anniversary of the discovery of America by Columbus, recommend the same as a general holiday for the people of the United States. On that day let the people, as far as possible, cease from toil and devote themselves to such exercises as may best express honour to the discoverer and their appreciation of the great achievements of the four completed centuries of American life."

This was the first celebration of Columbus Day. Now it is celebrated every year.

GEORGE WASHINGTON. FIRST PRESIDENT OF THE UNITED STATES. BORN FEBRUARY 22, 1732

It is interesting to know that the first public celebration of the Birthday of General George Washington took place during his own lifetime. General Washington was one of the few great men who did not have to wait until after death for recognition of his greatness. Commander-in-chief of the American Army in the great struggle for independence and first President of the new nation, he was adored by his soldiers and revered by the people.

It was his friend, Count de Rochambeau, who, as a graceful acknowledgment of the goodwill between France and the new country, first celebrated the General's birthday. The French Count had been in America barely six months and was stationed at Newport, Rhode Island, with his soldiers. His letter to General Washington, acquainting him with the holiday, is as follows:

"Yesterday (Sunday)" Count de Rochambeau wrote, "was the anniversary of your Excellency's birthday. We have put off celebrating that holiday till to-day, by reason of the Lord's Day and we will celebrate it with the sole regret that your Excellency be not a witness of the effusion and gladness of our hearts."

Washington received this letter while in his winter quarters in New York State, where he was anxiously watching the movements of the British army.

"The flattering distinction paid to my birthday," he replied, "is an honour for which I dare not express my gratitude. I confide in your Excellency's sensibility to interpret my feelings for this and for the obliging manner in which you are pleased to announce it."

After the Revolution, the celebration of Washington's birthday very naturally took the place of the observance of the King's birthday. Since then, Washington's birthday has been celebrated more or less generally throughout the United States, and to-day it is a public holiday in every state in the Union with the exception of the District of Columbia, Arizona and New Mexico.

ABRAHAM LINCOLN. PRESIDENT OF THE UNITED STATES. BORN FEBRUARY 12, 1809

Abraham Lincoln was a child of the soil. Born in what was then almost a a wilderness, he struggled upward with unswerving purpose against great odds. The contrast between the raw stripling

IN MEMORY OF WAR DAYS

This picture of Fort McHenry, near Baltimore, calls to mind the origin of our famous song, "The Star Spangled Banner." The author, Francis Scott Key, was confined on a British ship during the bombardment in September, 1814, and the flag mentioned in the poem was the one flying from the fort, which all the British power could not force the defenders to haul down.

The 30th of May is generally observed in the northern states as "Memorial Day," and patriotic services are held and the graves of the soldiers who died during the Civil War are decorated. Flowers bloom earlier in the southern states and therefore "Decoration Day," as the corresponding holiday is often called there, occurs as early as April, in some states. There is no uniform date in all the southern states.

of the western woods and the sad-eyed man at the helm of our nation through the storm of the Civil War is striking. But as the sculptor carved out of the solid marble the likeness of a man, so God carved out of the strong, rough stuff of the western boy a man to meet our needs. When our country was divided against itself, the North against the South, brother's hand against brother, it was Abraham Lincoln who saved the Union.

"With malice toward none, with charity for all," with firmness in the right as God gave him to see the right, he steered the nation through the terrible time of its strife. "The strain of mind, the anguish of soul that he gave to his great task, who can measure?"

When President Lincoln died a martyr's death at the hands of a fanatic, his great mission had been fulfilled. The republic as a single, individual whole was "so firmly bedded in the hearts, the minds and the blood" of its citizens that the question of dissolution will never again enter their thoughts.

Look well at the face modelled by Borglum shown on page 4840. Note the sane, sweet strength of the face, the firm, kind mouth, and the sad eyes and lined forehead that tell of great cares greatly borne. The story of Abraham Lincoln's life should be graven on the heart of every American boy and girl as a standard of high endeavour and selfless rectitude. Read it. It is on page 793 of THE BOOK OF KNOWLEDGE.

ROBERT E. LEE AND JEFFERSON DAVIS. BORN JANUARY 19, 1807: BORN JUNE 3, 1808

The birthdays of the two great leaders of the Confederacy, General Robert E. Lee, and President Jefferson Davis, are set apart as holidays in many parts of the South.

Jefferson Davis and Robert E. Lee were States rights men, that is, although they thought they owed a duty to their country, they believed that they owed a higher duty to the States in which they were born, so when the Southern States seceded from the Union, these men followed their states.

Lee was earnestly opposed to dis-union, but "If the Union is dissolved and the Government is disrupted," he said, "I shall return to my native state and share the miseries of my people, and, save in defence, will draw my sword against none."

Robert Lee had served in the Mexican War and was the ablest American officer at this time. When the Civil War seemed about to come, President Lincoln sent Frank P. Blair to offer him the command of the Army of the United States. General Lee's response to this offer was characteristic of the man, "I am opposed to secession, but I will take no part in an invasion of the Southern States," he said.

A little later he took command of the military forces of Virginia, then entered the Confederate service and finally became the General-in-chief. General Lee's grasp of the situation in the South was masterly, and with the tremendous odds against him, he was able to win many victories, but finally surrendered his army at Appomatox Court House.

General Robert E. Lee was not only a great commander, but he was a great man. He had the gift that drew men's hearts to him, and his soldiers gladly followed him. When the Southern army was surrounded at Appomatox and General Lee, unwilling to lead his brave fellows to certain death, surrendered, the men could not understand what had come to them. They had been preparing for battle and they gathered around in their tattered uniforms to listen to the announcement. General Lee has surrendered! It could not be possible! But it was, and the men who had followed him through battle, hardship and starvation, broke down and sobbed like children when they learned the truth.

General Lee bore defeat as greatly as he had borne his duties and loyally recommended the South to accept the result in good faith. He had gladly risked all his property in the desperate championship of the Southern cause, and at the close of the war he was offered the presidency of Washington College, Va., now Washington and Lee University. He held this position until his death.

Jefferson Davis, although perhaps not such a lovable man as General Lee, was a man of great ability and strength of character. He was popular throughout the South and at the beginning of the Civil War was elected President of the Confederacy.

The strain of the awful years of war

and the fact of his imprisonment in Fortress Monroe after the war, broke down his health, and when he emerged from prison he was an old man. The Southern people have never forgotten the hardships that this man bore for their sakes, and to-day his birthday, as well as that of General Robert E. Lee, is observed in several of the Southern States.

DAYS COMMEMORATING GREAT NATIONAL EVENTS. THANKSGIVING DAY. THE LAST THURSDAY IN NOVEMBER

The Pilgrims had been in the new world for nearly a year. The springtime sowing had taken place and all the summer the fields had been watched with great anxiety, for all knew that their lives depended upon the coming harvest. The summer crops came to a richness of fruition beyond all expectation and late one day in the fall Governor Bradford sent four men into the forests to shoot wild birds. "We will hold a harvest feast of Thanksgiving," he said, and invited the Indians who had been friendly to the strangers to rejoice with the white men. The Indians came bearing gifts of venison, and the harvest feast lasted three days.

This was the first Thanksgiving Day celebrated in America and little by little as new colonies settled the land the custom of a yearly Thanksgiving spread throughout the country.

General Washington perfectly expressed the spirit of the day in his Thanksgiving Proclamation in 1789:

"Whereas it is the duty of all nations to acknowledge the providence of Almighty God, to obey his will, to be grateful for his benefits, and humbly to implore his protection, aid and favours. . . . Now, therefore, I do recommend and assign Thursday, the 26th day of November next to be devoted by the people of these States to the service of that great and glorious Being, who is the Beneficent Author of all the good that was, that is, or that will be; that we may then all unite in rendering unto him our sincere and humble thanks for his kind care and protection of the people of this country, and for all the great and various favours which He has been pleased to confer upon us."

For a long time the celebration of Thanksgiving in the South was considered a relic of puritan bigotry and it was not until 1857 that the day began to be observed there. Until the Civil War the celebration of the day was merely a state affair. During the Civil War it was suspended for a time, but in 1864 President Lincoln issued a proclamation appointing the 4th Thursday in November thereafter as a National Thanksgiving Day. When Lincoln was assassinated it almost caused this rule to pass out of existence, but the succeeding presidents took it up and since then Thanksgiving Day has been regularly observed throughout the United States. The governor of each state receives the President's proclamation and issues a corresponding one for his state.

FLAG RAISING DAY. JUNE 14, 1777

Flag Raising Day was first recognised on June 14th, 1894, when at the request of "The Sons of the Revolution" and "The Colonial Dames of America," the Stars and Stripes were raised on all the public buildings.

The first American flag is said to have been made by Mrs. John Ross, an upholsterer and seamstress who lived in Philadelphia. (See page 1640.)

Previous to the adoption of the national emblem each colony had its own flag. But when the new flag was approved by Congress, it was at once copied by patriots all over the country.

The thirteen white stars in the blue field in the upper left-hand corner of the new flag represented the thirteen colonies, as did also the thirteen alternating stripes of red and white. Later when Vermont and Kentucky entered the Union the number of stars and stripes was increased to fifteen, but still later Congress voted to return to the original thirteen stripes, adding a new star on the 4th of July following the admission of each new state.

It was the sight of this glorious Stars and Stripes floating on Fort McHenry that inspired Francis Scott Key, imprisoned on one of the British ships, to write our national song "The Star Spangled Banner." (See page 2005.)

INDEPENDENCE DAY. THE FOURTH OF JULY

Independence Day is a holiday that is observed in each and every state in the Union, and celebrates the adoption on July 4, 1776, of the Declaration of Independence, which declared our separation from Great Britain. It was Richard Lee

who proposed to Congress "That these United colonies are and of right ought to be, free and independent states; that they are absolved from all allegiance to the British crown; and that all political connection between them and the State of Great Britain is, and ought to be dissolved." John Adams seconded the motion, and Thomas Jefferson drew up the Declaration of Independence which has made him famous for ever.

At the time of the adoption of the Declaration John Adams wrote his wife a letter which was to be a prophecy: "I am apt to believe," he said, "that it (the day) will be celebrated by succeeding generations as the great anniversary festival. It ought to be solemnised with pomp and parade, with shows, games, sports, guns, balls, bonfires and illuminations from one end of this continent to another, from this time forward for evermore."

With true patriotic fervour Americans have thrown themselves into the celebration of this glorious event. But alas! the harmless fireworks and bell ringing of the earlier days have given way to pistols that cause tetanus and lockjaw and giant firecrackers that often injure fingers and destroy eyes. General statistics taken in 1910 showed the horrified public that in eighty-three of the largest cities of the United States an average of 4,543 boys and girls were being killed and injured every Fourth of July.

For some time there had been an attempt to limit the sale of fireworks, and now it was resolved that something must be done at once. Parades, decorations, illuminations, music, speakers, sports, and refreshments became the order of the day. The result was that in 1910 and 1911 the number of deaths and accidents fell to about one-fourth that of previous years and in 1912 the record was still better Each year the authorities are striving still further to decrease the number of accidents, and it is the duty of every patriotic American boy and girl to help in the establishment of a true, sane and jubilant celebration of the signing of the Declaration of Independence.

DANGEROUS FUN

MEMORIAL DAY. MAY 30TH

Fifty years ago our country was convulsed by a terrible Civil War. Brave men left their homes and their families by the thousands to join the Army of the Blue or the Gray. Men burned with the zeal of patriotism and whether they

fought for the Union or for the South, they fought for the cause they thought was right. The women of the North and the South remained at home to sew and pray for the safety of their loved ones.

At last peace was established. The Union was saved, but at the cost of thousands of the lives of our country's bravest men. There was scarcely a village or a neighbourhood in the North and none in the South that did not have its dead.

The women of the Confederacy began to go at various times in different places to strew flowers on their soldiers' graves, and presently the custom spread to the North. General John A. Logan, commander-in-chief of the Grand Army of the Republic, set aside May 30th as Decoration Day for the graves of the Union soldiers who had died in the Civil War. Gradually the observance spread from State to State, and the name was changed to Memorial Day, the better to voice the feelings of those who observed it. As flowers appear earlier in the South the date of the observance is earlier there, in some states on April 26th, in others on May 10th.

DAYS SET ASIDE FOR PUBLIC SERVICE TO OUR COUNTRY. ELECTION DAY. FIRST TUESDAY AFTER THE FIRST MONDAY IN NOVEMBER

We have been considering holidays which are memorial days, days set aside in memory of some great event or some great man. Now we come to those days which have been made holidays for the performance of some public duty.

Presidential Election Day comes once every four years and Congress has appointed the first Tuesday after the first Monday in November for this purpose, and almost all the States have chosen the same day for the election of their State officials.

No day brings greater responsibilities than Election Day. In most States every man over 21 years of age and in ten states women as well as men go to the polls to cast their votes for the men who are to govern them and make their laws. In olden days the government was in the hands of a powerful few and it is only within a few generations that the franchise has passed into the hands of the citizens.

Since the signing of the Declaration of Independence the United States has stood for liberty and equal rights, and each voter who enters the polling booth is claiming his privilege to take part in the government of his country. The right to vote is something that every American boy and every American girl (for the time seems to be coming when all women will vote) should think about very seriously, for the future welfare of our country lies in right voting, in voting for honest measures and honest men to carry out those measures.

ARBOR DAY

Arbor Day has been set aside by many States for the planting of trees and shrubs along the highways and in other places where they are needed. One purpose of this celebration is to implant in our boys and girls — our future American citizens, a love of Nature and the wonderful world about them. Another purpose is to impress the necessity of planting trees for the future.

There is no uniform date set apart for Arbor Day, as it necessarily varies in different States owing to the differences in climate. It was first observed by the State Board of Agriculture of Nebraska offering prizes for counties and persons planting the largest number of trees and vines throughout that state, with the result that over one million trees were planted in the first year, and over 350,000,000 trees and vines within the twelve succeeding years. In the West there are many treeless plains and this beautiful and useful custom of planting trees at once aroused the interest of other States, and the plan was generally taken up throughout the country. The New York public schools celebrated the day for the first time in 1889.

In the past people have been wickedly wasteful in the way they have cut down the abundant forests all over our country. We are still destroying trees much faster than others grow to take their places.

The boys and girls who have kept Arbor Day year after year, planting small saplings and watching them grow inch by inch until at last they overhang the roadside, know the real value of a tree. They know it means cool, sweet air (see page 5629), and a shady place to rest, and a beauty as straight and strong and soul-satisfying as God has ever made. Arbor Day stands

for the preservation of our forests all over the land.

Other Holidays

Besides the holidays already mentioned there are many other days of local importance merely, that are observed in the different states. For instance, Patriots' Day, April 19th; and Forefathers' Day, December 21; are kept as holidays in Massachusetts and the former also in Maine; March 4th, every four years, is set aside for the Inauguration of the new President in the District of Columbia; May 20th, the anniversary of the signing of the Mecklenburg Declaration of Independence, is observed in North Carolina; March 2d, the anniversary of the Texan Independence, is celebrated in that state, while Good Friday is a holiday in some states.

Labor Day. The First Monday in September

The first Monday in September is generally observed all over the United States and Canada as "Labor's Holiday." Then the great army of workers, rich and poor alike, all over the country, put aside their tasks for a day of rest and pleasure.

Labor Day was made a holiday in the District of Columbia by Congress in 1894 and is a holiday in the same sense as Washington's Birthday or the Fourth of July. But so far as the cessation of ordinary business is concerned — the signing and falling due of notes, the lawfulness of customary transactions, and so forth, Congress has no power to create a holiday in the States. The Congressional bill makes Labor Day a legal public holiday in the District of Columbia and requires the closing of all Federal offices throughout the United States.

World Holidays Observed in the United States. New Year's Day, January 1. Christmas Day, December 25

Both New Year's Day and Christmas are legal holidays in the United States. The custom of making and receiving New Year's calls is not as prevalent as it once was; but wherever the winter climate will permit New Year's eve is celebrated with horn-blowing, fireworks and jollity. In Pasadena, California, a lovely fête of roses is given on January first, when beautiful processions pass through the gaily decorated streets, while automobiles, carriages, horses, bicycles and "floats," often having historical significance, are trimmed profusely with roses of every hue.

Christmas, as every boy and girl knows, is a most delightful day. People all over our broad land, even those who do not recognise its beautiful religious significance, unite joyously in this time of gift-giving and "good-will to all mankind."

Long ago in the Puritan colonies, all exhibitions of gaiety and happiness were

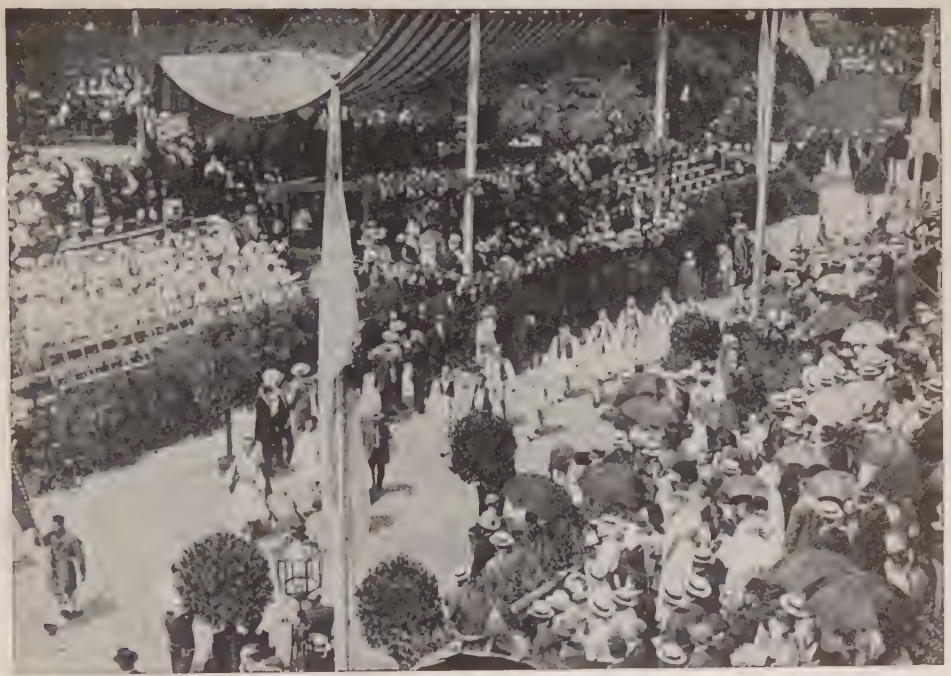
CHRISTMAS IN MANILA

considered sinful and Christmas was not observed. In fact, the stern old Pilgrim Fathers made a law, forbidding anyone to celebrate Christmas on pain of arrest and punishment. Now-a-days, however, Christmas is celebrated in New England just as it is everywhere else.

Within the last few years our flag flies and is at home on other parts of the globe besides North America, so the Hawaiian children under the palm trees and knowing only heat and summer, and the Alaskan babies in their warm fur coats, looking out on snow and ice, and having but two hours of daylight during the winter months, celebrate the day as becomes "Young Americans."

Even under the tropic sun of the little, far-away island of Guam and in the group of islands we call the Philippines, the natives decorate their homes and try to be "American" when it comes "gift-time." And we, and all the peoples of the earth who know about it, make gifts at Christmas time because long ago, "Behold, Wise Men came from the East . . . and when they saw the Young Child . . . they presented him with gifts."

A SAFE AND SANE FOURTH



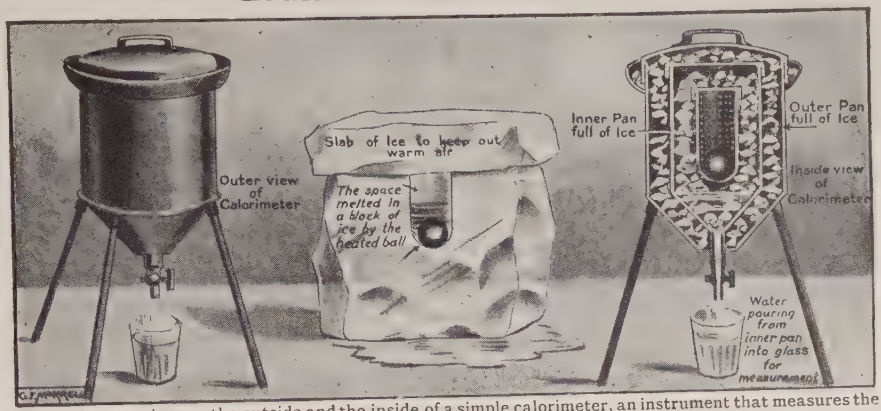
The old-fashioned Fourth of July with its firecrackers and explosions of powder has become so dangerous, that all over the country the attempt is being made to substitute other forms of celebration for the noisier forms. This picture shows part of a parade of nationalities in New York City.

This picture, also made in the vicinity of New York City, shows an obstacle race, which was one event in the games held in celebration of the day. The authorities in this city have forbidden the sale and discharge of firecrackers, and fireworks may be set off only by special permission given to responsible parties.

ARBOR AND THANKSGIVING DAYS

This picture made from an old print shows the artist's idea of the celebration of the first day of Thanksgiving at Plymouth, Massachusetts, about which the old records of the Pilgrim Fathers tell us. It is interesting, even if it is not entirely accurate. Its quaintness makes it attractive.

The celebration of Arbor Day originated in the western prairie states, where there are very few trees, and a day was set aside for the planting of trees and vines and shrubs. In other states the rapid destruction of the forests had led the teachers to use the occasion to tell children of the importance of trees and to teach them to recognize the different kinds.


Outer view of Calorimeter
Slab of Ice to keep out warm air
The space melted in a block of ice by the heated ball
Inner Pan full of Ice
Outer Pan full of Ice
Inside view of Calorimeter
Water pouring from inner pan into glass for measurement

These pictures show us the outside and the inside of a simple calorimeter, an instrument that measures the quantity of heat in a thing, as a thermometer measures its level of heat, or its temperature. The amount of heat is shown by the quantity of ice melted. The middle picture explains how the instrument works.

HEAT AND TEMPERATURE

CONTINUED FROM 4371

THERE are very many important facts for us to learn about heat. The principal thing we have to understand is the difference between heat and temperature. The word thermometer means heat-measurer, although the thermometer does not measure the amount of heat, but only its level, just as one might measure the height of the water in something, and say it stood at such a level, without asking whether it was in a well or in the ocean. In such a case we do not concern ourselves with the amount of water; neither does the thermometer concern itself with the amount of heat. We shall see shortly how the amount of heat can really be measured, but the way to lead up to that is to study what is called *latent heat*.

The general rule is that when heat is given to a certain quantity of anything, or taken from it, its temperature changes. We might expect that this would always happen—that we could not add heat to a thing without making it hotter, or take heat from a thing without making it colder.

Yet it can very easily be proved that such is possible, and also that it does not contradict in the least the law that no kind of energy can be lost, and that all must be accounted for. If we take ice at the melting-point, and add heat to it, we do not raise its temperature; or if we take water at the freezing-point, with ever so small a piece of ice in it, we can take heat from it, and yet its temperature does not fall; or if we take a mixture of ice and water, we can add heat to it, or take heat from it, without altering its temperature. Lastly, if we take liquid water at the boiling-point in the open air, and add any amount of heat to it, not too rapidly, we make it no hotter. The liquid water disappears, and takes the form of water-vapour, which is itself no hotter than the liquid water was.

All these are illustrations of what is called latent heat. What is true of water is true of other things. Now, what we notice in every one of these illustrations is that though the temperature of the water is not changed, its state is. In one case we have ice turning into liquid water; in another, liquid water turning into ice; in another, liquid water turning into water-vapour.

Here is the proper definition of latent heat, and, though it is rather long, it is perfectly clear: "Latent heat is the quantity of heat which must be communicated to a body in

a given state in order to convert it into another state without changing its temperature." That is exactly what these examples illustrate. The heat seems to have disappeared as heat when we put it into ice and turn the ice into liquid water no hotter than the ice was, and so we say that it has become *latent*, which is a Latin word that means "lying hid."

The opposite term to latent heat is *sensible heat*. Here the word sensible is used in its proper meaning, and a thing is called sensible because it can be sensed, or felt. So, when we give heat to a thing and make it warmer, we call it sensible; but if we give heat to a thing and make it no warmer, we say that the heat becomes latent. We must clearly understand from the first that if the heat does not make the thing warmer, then it must change the state of the thing; the heat has to be accounted for in any case. We may quote the simple language in which Lord Kelvin—the great master of this subject, and such a master that he could write about it in simple words—explains to us the right meaning of the words sensible and latent heat.

THE HEAT THAT CAN BE FELT AND THE HEAT THAT CANNOT BE FELT

"Thus, when heat given to a quantity of water warms it, the heat becomes sensible to a hand held in the water. When a basin of warm water and a basin of water and ice are placed side by side, a hand dipped first in one and then in the other perceives the heat. If now the warm water be poured into the basin of ice and water, and stirred for a few seconds of time—unless there is enough of warm water to melt all the ice—the hand perceives no warmth; on the contrary, it perceives that the temperature is the same as it was in the basin of ice and water at the beginning. Thus the heat which was sensible in the basin of warm water has ceased to be sensible in the water that was in that basin, and has not become sensible in the other. It is therefore well said to have become latent."

The facts of latent heat give us a means of measuring heat itself, for we can measure the amount of ice that can be melted into water without change of temperature, and the more ice that is so melted, the more the heat that is employed. It does not matter in what form the heat is applied; we can measure it equally well. A given quantity of ice may be melted into water of the same temperature, either by being exposed to a great deal of warmish water or to a little very hot water. But we know that in each case the amount of heat there must have been the same, because it does the same work, turning the same amount of ice into ice-cold water.

THE AMOUNT OF HEAT IN A THING IS NOT THE SAME AS ITS TEMPERATURE

The old name for heat when it was supposed to be a fluid was *caloric*, and the name for the instrument that measures heat is *calorimeter*. We must never mistake the absolute difference between a calorimeter and a thermometer; the one measures the quantity of heat, and the other measures its level.

We are, nowadays, accustomed to call a fixed quantity of heat a caloric, and that will help us to remember the word calorimeter. Of course, in ordinary language we have the word heat for both purposes. When we say latent heat, we mean heat itself; when we talk of summer heat, we do not really mean heat itself, but temperature, or heat-level.

Two great and famous Frenchmen, Laplace, the great astronomer, and Lavoisier, the chemist, whose splendid head was cut off at the Revolution, invented the first calorimeter, which measured the amount of heat by the amount of ice melted. We see a picture of this instrument on page 4473. Another method might be employed. When ice is turned into ice-cold water, heat becomes latent; but heat becomes latent also when boiling water is turned into water-vapour, and so it is possible to make a calorimeter that depends on measuring the amount of water evaporated by heat.

HOW TO MEASURE THE AMOUNT OF HEAT IN ANYTHING

We can also measure the amount of heat, without any reference to latent heat at all, by taking water or some other substance at a fixed temperature, and noticing how much a given quantity of it has its temperature raised.

When we come to consider the doctrine of latent heat in the light of our modern knowledge of matter, we see that, though the term is worth keeping,

it is rather misleading. The truth is that when ice is turned into ice-cold water by putting heat into it, the heat which disappears is really turned into something else—something else that makes the difference between liquid water and ice. This something else is the motion of the molecules of the liquid water; and what has really happened is that the heat motion has become turned into that motion upon which the liquidness of the liquid water depends.

In the same way, when boiling water is turned into water-vapour of the same temperature by having heat added to it, and when we say that the heat has become latent, what we really mean is that the heat motion has been turned into another kind of motion—the motion of the molecules making up water-vapour. We know that all gases, including water-vapour, consist of molecules in very rapid movement. Part of this we must suppose to be the special kind of movement called heat, and of this there may be less or more, because a gas may be hotter or colder.

How heat motion changes into the motion that makes steam

But when liquid water is turned into water-vapour of the same temperature, there is really no more heat motion in it, but the heat put into it has been turned into motion of another kind—that kind upon which depends the difference between water and water-vapour. Yet we may still retain the term latent heat, as Lord Kelvin has shown us, and in all such cases as this we shall find, if we go the right way about it, that we can get back again from the substance the heat we have put into it, while it loses that special kind of motion in which the heat we put into it has been "lying hid."

Now, there is another very important phrase, *specific heat*, which we must study. If we take a given quantity of water and a given quantity of something else, both at the same temperature, and put a certain amount of heat into them, we find that the something else, whatever it is, becomes hotter than the water does. The only exception to this rule is hydrogen gas. Apart from that, it is true that, in order to make water hotter, we require to put into it more heat than into any other substance. We have to study, in the case of every substance, its behaviour in this respect, and so we learn what we call its specific heat. For convenience, we call the specific heat of water 1, and then the specific heat of all other substances, except hydrogen gas, is less than 1.

Why the same amount of heat makes one thing hotter than another

The chemists have discovered certain very remarkable laws about the specific heat of different things. It is not a matter of random chance that the same amount of heat given to the same amount of copper and iron, at the same temperature, will not raise the temperature of each of them in equal degree.

We find that there is a law in this matter, and the specific heat of a substance depends, to a great extent, upon the size and weight of the atoms of the substance. If an element has very big and heavy atoms, there will be fewer of them required to make up the given weight of that thing—say, an ounce—than will be required to make up the same weight of another element which has smaller and lighter atoms. The fewer the number of atoms, the more heat will there be, so to speak, for each of them; and so the bigger its atoms are, the more the temperature of a thing will be raised by a given amount of heat.

In other words, the bigger its atoms are, the less heat will be required to raise its temperature to a given degree. The proper way of saying this is that, as a rule, the specific heat of a thing is "inversely proportional to its atomic weight." This celebrated law is rather difficult to get hold of when first we hear it, but it applies so widely, and has such an important explanation, that we must try to understand it.

The reason why the tea-pot keeps hot so long

The very high specific heat of water has important consequences in practical life, and this is, indeed, one of the most valuable properties of this wonderful compound. If we made tea with any other liquid than water, or if we put any other liquid than water into a hot-water bottle, we should find that the tea or the hot-water bottle got cold far more quickly than usual. The fact that water has such a high specific heat means that it will hold a lot

of heat, so to speak. The amount of heat in a given quantity of boiling water is greater than that in the same quantity of anything else at the same temperature, just because its specific heat is higher. This means that if we wish to boil cold water, we have to put more heat into it than we should have to put into anything else, and it also means that when we have got the water boiled, there is a great deal of heat there, and so it takes a long time for the hot water to cool.

THE HEAT STORED UP FOR US BY WATER

All this means that water is a great storer of heat, and this fact is equally true of a full tea-pot, or a full hot-water bottle, or of the ocean round our shores. We now see more clearly than before the key to the great virtues of island climates compared with inland. The water around the islands could not do what it does if it were not for this high specific heat of water combined with its great conducting power.

This means that, in the summer, water can swallow up enormous quantities of heat, quite out of proportion, so to speak, to the extent to which it is made hotter. Nothing else could swallow up so much heat except by turning it into latent heat and becoming gaseous. These enormous stores of heat that are collected in the summer can be given back to moderate the climate in the winter; and yet the sea, though giving up such great stores of heat, is not cooled so much that it is compelled to freeze.

This must conclude our study of heat. It is a subject about which too much cannot be known, because of its immense practical importance in relation to all kinds of machinery, and the using of power for the purposes of human life; and it is a subject about which too much cannot be known, also, because of its great bearings on our ideas of the universe, and the history and destiny of things in general.

THE IMPORTANCE OF THE LAWS OF HEAT TO ALL KINDS OF MEN

There is, perhaps, no other subject in the world which so directly concerns the man who wishes to save a penny in the dollar in the working of his factory or his motor-car, or the pure philosopher who wants to know the laws and course of Nature. That is why one of the greatest of all the achievements of the nineteenth century was the discovery of the nature and laws of heat, unknown to, and misunderstood by, all preceding ages.

The discovery of these laws is of enormous daily importance to every one of us now, and it furnishes the proof of that greatest of all scientific ideas, to which science is continually bound to refer—the truth that while all things can be changed into other things, while all forms of power, such as heat, can be changed into other forms of power, yet nothing is made out of nothing, nor is anything ever destroyed. This greatest of all scientific truths, the law of the conservation of energy, was seen, as by the eye of a prophet, by the earliest thinker of whom we have any record, and has played a part in the history of the human mind for 2,500 years.

But the proof of it was not obtained until the nineteenth century after Christ, and we owe that proof to the great men in Germany and to the great Lord Kelvin, who found, in their study of the laws of heat, the fixed and eternal relations which obtained between heat and other forms of power.

THE DISCOVERY THAT HEAT AND ENERGY CAN NEVER BE LOST

We have seen that heat is not a thing in the same sense that a chair is a thing, as was once supposed to be the case, but that it is really a form of motion. The discovery that this form of motion can be changed into other forms, and that the change, in either direction, proceeds so that nothing is lost or made, was absolutely necessary if the great idea of the conservation of energy was to be proved. The fact of the equivalence, or equal value, of heat and work is now proved.

Equally important is the discovery that heat is produced by chemical changes, as in a fire, or that, in other chemical changes, heat is used up and disappears. In these cases, also, it is possible to account strictly for all the heat that seems to be made or seems to be lost. Such instances, therefore, are only a few additional proofs of the fact that in Nature it is quite impossible for anything ever to be lost.

The next part of this is on page 4581.

This series of pictures shows an ancient Egyptian potter carrying out the different processes of his trade.

THE CHINA ON THE TABLE

HOW CUPS, SAUCERS, AND PLATES ARE MADE

CONTINUED FROM 4436

THE poorest people in the land can afford to have china cups and saucers and plates on their tables. Few things in the house are cheaper than earthenware and crockery, and its method of manufacture, with its history, is quite a romance.

There are the powder of mountains and the bones of long-departed animals in the cup from which we drink, and in the plate from which we eat our breakfast. Millions of years ago, granite mountains were raised on the earth, and in millions of years these were worn down by the effects of the weather, until they were slowly ground into powder. That powder settled down on the lower-lying land and became the clay from which our cups are made, sometimes called kaolin.

We cannot afford to put much of that clay in the common china. In a mixture which the potter turns into cheap cups and saucers, there are only 40 parts of the china-clay, while there are 180 parts of burnt bones, 70 parts of common clay, and 75 parts of ground-up flints.

The clay is all very carefully mixed by machinery before the potter works on it, and it goes to him in lumps, like heavy dough. He is the knight of the throwing-wheel. This is a contrivance which has been very little altered in principle since the potters of ancient Babylon and Nineveh used wheels very much like it, before even the Bible was written.

The throwing-wheel revolves horizontally in a pan. It is a sort of disc, and the pace at which it goes round is fixed by the foot-brake which the potter controls, while the driving power comes from a fly-wheel at the other end of the table on which he works. The fly-wheel may be worked by hand or by machinery.

As the throwing-wheel spins round on its axle, the potter throws the clay. It sticks to the throwing-wheel, and goes round with it. Then the art of the potter comes into play. He moulds it as it spins, moulds it with his skilful hands or with tools made for the purpose. Gradually the shapeless mass of clay becomes a cup, or it may be a basin or a vase—something merely useful, or something beautiful in shape. He works from the base upwards, shaping the walls, making them the right height and thickness. Then he puts aside the vessel to dry, so that it can be fixed on a lathe, and turned and smoothed.

Of course, not all articles are made in this way. A beautiful cream-jug may be made in three or four separate pieces. For the making of plates, the potter fixes a mould to his throwing-wheel. This mould, filled with clay, is spun round on the wheel, an arm presses down upon it, squeezes the clay to the shape of the mould, and then pares it down to the proper thickness.

HOW THE CLAY VESSELS ARE BAKED IN THE OVEN

When all this is done, the more scientific part of the work has to follow. First of all, the vessels are placed with others in a drying-stove of moderate heat. After this, they are packed in things like small ovens, called seggars. The furnace is lighted, and the heat is drawn up all round the seggars, which remain in the furnace for over forty hours. The fire is then allowed to cool, and the seggars, on being opened, reveal what is called biscuit-china.

If we are making common earthenware things, we do not treat them like this. We open the seggar while it is in the furnace, and throw in common salt. This salt is turned into vapour by the heat; the vapour mixes with other vapours already in the seggar, and settles in the form of a transparent, glazed layer all over the articles within.

With the superior china we have to be more careful. Patterns are painted on, and the article is dipped into a liquid glaze. Then the vessel is put back into the seggar and restored to the kiln, where the heat is gradually raised until a temperature is reached which has to be maintained for about fourteen hours. After cooling, the seggars are taken out, and we have cups and saucers, or it may be dainty porcelain vases.

HOW A HORSE'S ILLNESS GAVE RISE TO A NEW IDEA IN POTTERY

Some English potters were remarkable men. The first with whom we need concern ourselves is John Astbury, who was born about 1688, and died in 1743. He was the first to manufacture cream-coloured pottery. He did more than that. One day he saw an ostler trying to cure a horse by blowing into its eyes the powder from a red-hot flint-stone. Astbury thought that flint-stones burnt to powder might be more usefully employed than as a doubtful medicine for horses, and, after experimenting with the powder, he found that it was a valuable substance for making pottery. At about this time there were two brothers from Nüremberg, named Elers, at work in Burslem, the English home of the pottery trade. These were the men who discovered how to glaze common pottery by scattering salt in the seggars. But they had another secret—the making of a pretty red ware which they called Japanese. By pretending to be an idiot, Astbury got into their works and learned their secret.

One of Astbury's brothers married a Miss Wedgwood, the aunt of a boy named Josiah Wedgwood, who was born at Burslem in 1730, and died in 1795. When Josiah was only nine, his father died, and, though the family was a respectable one, it was very poor, and Josiah never went to school after he was nine. Smallpox left him lame in one knee, and, after fifty years of suffering, he had to have the damaged leg amputated.

THE MAN WHO RAISED POTTERY TO A FINE ART IN ENGLAND

After very hard struggles, he built up a great business. He did so solely by merit. He discovered new materials for his pottery. He found out new processes. He made good crockery for the table and lovely things to adorn the house.

Pottery became very bad after Wedgwood's death. It remained for Sir Henry Doulton to exalt it to a fine art. Sir Henry's father was in a very small way of business, making blacking-bottles and other common things, when his son, who was to become famous, was born. But the father was a fine fellow, and gave his son a good education. Henry discovered the art of making drain-pipes of glazed earthenware. That was a great thing for the world. Until that time all drains had been simply channels of bricks, which let poisonous matter leak through in all directions. The Doulton pipes created a revolution in sanitation.

From that kind of work Doulton went on to the making of the famous Doulton ware. The Doulton works are to-day of world-wide renown, and the pictures on the following pages were taken in these works.

At first we manufactured only rude pottery in America, but now artistic and useful articles are made, though we can not yet compete with Europe.

The next Familiar Things are on page 4585

THE LUMP OF CLAY THAT BECOMES A CUP

The cups and saucers that are on every table in our homes, and the beautiful vases that adorn our homes, do not look as if they were dug out of the earth. Yet this is really the case, and, although they go through many processes before they are fit for use, they first come from the ground as this lump of clay in the picture.

Most of the china-clay used in Britain comes from Cornwall. It is taken to the pug-mill, where the lumps are kneaded and mixed with water until the water becomes like milk. Other substances are mixed in, and the whole stands in presses until the clay settles, when it is taken out as shown here. Pug means to knead or pound.

HOW THE DINNER-PLATES ARE MADE

In making plates, a mass of clay is thrown on to the potter's wheel. It is then flattened to an even thickness all over, and moulded to a pattern by a gauge which ensures absolute accuracy of size and shape. In the picture we see a rough lump of clay on the potter's wheel, while just in front of the potter is a plate that is being shaped.

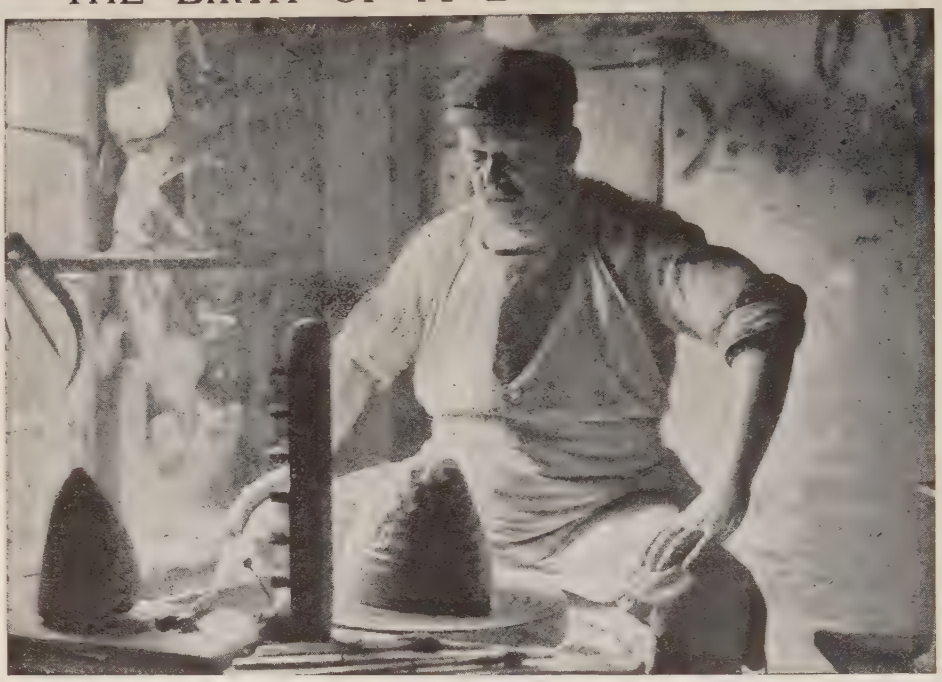
Here we see a plate being trimmed and gauged, to ensure that it is the same size as the others. As soon as a plate is shaped, it is taken by the boy standing on the left to the drying-stoves. If we look at most plates, we shall observe three little marks on the bottom. These are caused by a little article, called a cockspur, which prevents the plates from touching when they are piled one above another in the seggars during the baking process.

FORMING THE CLAY INTO TEA-CUPS

Here we see the potter making tea-cups. Little balls of clay are thrown upon a rapidly revolving disc, which is called the potter's wheel, and is almost the same as the potter's wheel spoken of in the Bible, that was used thousands of years ago. As the wheel turns, the potter shapes first the outside and then the inside.

In this picture the potter is giving the final touch or two to the rough shape of the cup before it is dried. All the cups must be of the same size and weight and thickness, and the men are very skilful in making them uniform, as we can see by examining the cups of our tea-service at home. The potter also works very rapidly.

THE BIRTH OF A BEAUTIFUL VASE



All pottery that is round in shape is made on the potter's wheel, and it is a wonderful sight to see the formless clay grow into a beautiful vase under the potter's skilful handling. As the wheel spins round and round, we see the clay gradually assuming shape. With a deft touch here and a slight pressure there, the potter gives character to the clay, until, with a final whirl, the wheel stops, and there is the vase ready to be baked and glazed.

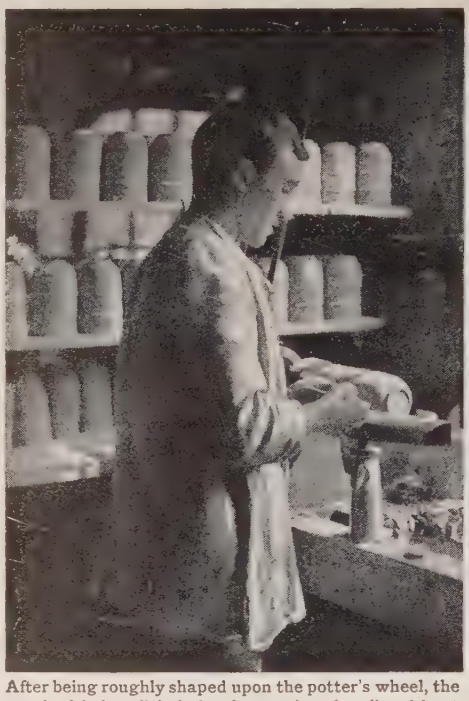
Here we see the vase after the potter has been working upon it for a short time. He has begun to give shape to the clay. The potter's art is one of the oldest in existence, dating back into prehistoric ages. The earliest pottery was shaped by hand without the aid of the potter's wheel, and it was made of coarse clay. Simple means of decoration were employed, the potter often making a band of circles by impressing the clay with a hollow stick.

THE CLAY GROWING INTO A VASE

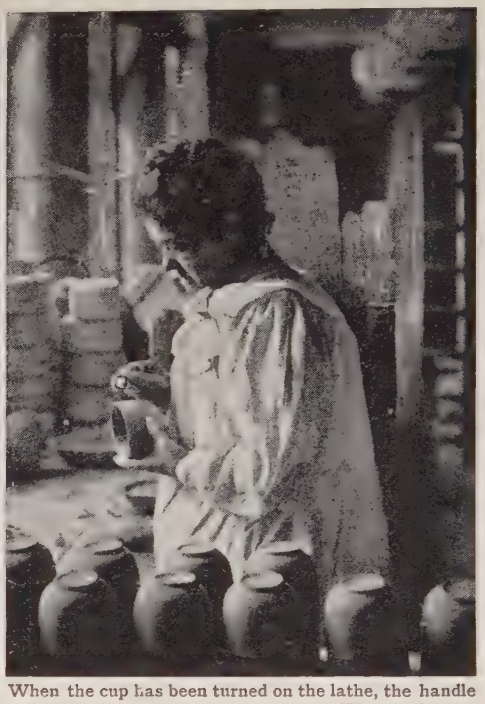
In this picture we see the clay growing into a vase. The hand and eye of the potter, working in harmony, produce beautiful lines and graceful curves. Sometimes the potter and the artist between them turn an ugly lump of clay, worth a few cents, into a lovely vase, for which rich men will give hundreds of dollars.

By lengthening the neck and giving grace to the body, the potter has now made the vase a work of art. When this particular vase has been baked and glazed and painted, it will be worth a very large sum and will grace some noble mansion or royal palace. A king of Prussia once exchanged some vases for a regiment of soldiers

POLISHING AND BAKING THE CUPS



After being roughly shaped upon the potter's wheel, the cup is dried until it is hard enough to handle without being injured. Then it is put upon a lathe, as we see in this picture, and turned until the shape is quite accurate.



When the cup has been turned on the lathe, the handle is fixed on by a woman, as seen here. We now have a hard clay cup that would soon get soft again, and become a shapeless mass, if water or tea were put into it.

The cups now have to be baked. They are packed into boxes made of fire-clay that are called seggars, meaning "safeguards," and are placed in furnaces. The seggars are left in the furnaces for about 40 hours. When they are taken out, the cups are ready for glazing. This picture shows the cups being packed into the seggars.

THE CUPS ARE READY FOR TEA

After being baked, the cups and plates have to be decorated, and the commonest method is to use the ordinary transfers that are known to all of us. Only the best china cups and plates are decorated by hand, and they are too expensive for general use. The transfer designs are first printed upon sheets of paper, as shown in this picture.

The work of transferring designs to cups and plates is generally done by girls and women. The design is placed face downward upon the article to be decorated, and it is then rubbed until the pattern is transferred

The glazing of china is a very important process. In the cheaper forms of pottery, such as drain-pipes, it is performed by throwing salt into the furnaces. Cups and similar articles are dipped into a liquid glaze, and, after being allowed to drain, like those in the picture, they are baked once again, and are then ready for the shops

THE NEXT PICTURES OF FAMILIAR THINGS ARE ON PAGE 4585

FLOWERING LOCUST

The common locust has such handsome foliage, and such quantities of fragrant white blossoms, that it was planted extensively in European parks, although it is easily damaged by high winds.

TULIP TREE

A tulip tree, or yellow poplar, grown in the open is shaped like a cone, its trunk rising in the centre as straight and round as a column. The wood of this tree is very valuable for commercial purposes.

FLOWERING DOGWOOD

Dogwood trees grown in an open field look like small apple trees. The foliage takes on brilliant scarlet lines in fall, and the close clusters of berries are even redder.

MOUNTAIN LAUREL

Mountain laurel is one of the handsomest of American evergreen shrubs. It blooms in June, and is often transplanted to parks and gardens, being almost as interesting in winter as in summer.

SOME STRIKING AMERICAN SHRUBS

CONTINUED FROM 4424

ONE usually thinks of a shrub as quite tall, rather like a small tree, or at least like a bush, yet some shrubs creep along the ground and others climb high into the trees. To put it as plainly as possible, a shrub is a woody plant that does not die down to the ground each winter, but keeps its side-shoots from year to year, breaking into bloom each season from buds on these shoots.

Trees soon lose their side-branches, at the base of the trunk, as they grow taller, and shoot up into tall shafts, crowned by most of the branches, growing in a head. Upright shrubs, on the contrary, retain their lower branches more frequently and become "bushy" in appearance.

THE TRAILING ARBUTUS

Among the shrubs that creep, is one that grows in many parts of eastern North America but is particularly dear to the people of Massachusetts. It is the trailing arbutus. It grows during the summer, shooting out long branches that trail along the ground, taking root here and there. Its leaves are oval, or almost round in outline, leathery, rigid and evergreen. By autumn, the clustered buds at the end of the hairy twigs are almost ready to open. But they do not do so. Cold weather sets in, dead leaves drift over the plants, and, singularly protected by them, the arbutus waits until the spring sun warms it; then the flowers have but little growing to do, and soon open, among the first flowers of the season. Without doubt they were the first pretty flowers the Pilgrims found. Mayflowers they are called sometimes and, very frequently, May-pinks.

The flowers themselves are salver-shaped, waxen, and pink or white. They have a delicious "woodsy" fragrance that reminds one of sweet birch and wintergreen, the spicy little evergreen shrub, that is so close a relative of the arbutus, for, with the laurel, the azalea and the bearberry, they both belong to a large family — that of the heaths — which contains a great many odorous, white or rosy-flowered shrubs.

PINK AND WHITE AZALEA

The lovely pink azalea, or pinxter-flower, as it is quaintly known from its

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habit of blooming about Whitsuntide, or Pinxter, in early spring, is also called wild honeysuckle, and not without some reason, for its lovely coronets of delicately-cut, long-tubed flowers, poised on slender, brittle stems, do suggest honeysuckles, except for their colour. The resemblance is aided by the quintette of very long stamens and two pistils, which are thrust out far beyond the petals. This character would lead one to suppose that wind carried the pollen from flower to flower. But the pollen grains are so coated with a viscid substance that strings of them may be drawn from the anther-cells by the slightest touch of the finger. This leads one to believe that insects are the messengers desired. The rich fragrance of the pinxter-flower would also seem to be an attraction for insects. There is a white azalea, that blooms in midsummer, in swamps, that is still more fragrant.

MOUNTAIN LAUREL

The mountain laurel or kalmia, however, although very closely related to the azalea, is scentless. But so brilliant is the display of bloom on this evergreen shrub, which sometimes grows ten feet or more high, that no odour seems necessary even at night. It bears great flat-topped masses of flowers ranging in hue from white to deep pink, set off, like an old-fashioned bouquet, by a salver of stiff, shining lance-shaped leaves, very dark green in colour. Each flower is worth studying. It is like a saucer, which has a five-sided, rather than circular, rim. At each angle, and in each space between the angles is a small pocket, which projects on the outside like a little knob. Look at a newly opened flower. You will see that each one of the ten pockets has the tip of one of the ten stamens safely stowed away within it. Its filament springs in an arch from the centre of the blossom. Run your pencil over the tops of the arches. You will probably jump with surprise, for every one of those stamens has jerked its tip out of its pocket, and is standing stiffly erect. Now if your pencil had been a blustering bumble-bee, he would have been well thumped by the upspringing stamens, and well dusted by the pollen jerked out of the open mouths of the pair of quaint jugs that form the anthers. He would have flown away, disgusted, and lit on another flower, whose trap had been previously sprung, perhaps, and would have rubbed off some powder on to the ready stigma. Thus he would have done what was expected of him, and the laurel seeds in the second flower would have been benefited in a way that it would take too long to explain, but which results in the contents of the pollen-grains getting down to the very young seeds through the pistil.

Masses of laurel leaves, as they endure transportation well, are stripped from the bushes and used for holiday decoration. One should be careful about throwing them, when discarded, within reach of young browsing animals, for this foliage contains a poison more deadly than strychnine, and many animals have been killed by eating it. Sometimes children are poisoned by eating the young seedling plants instead of wintergreen, which they much resemble, although they lack the spicy taste. Honey made from laurel bloom is also said to poison those who eat it. The narrow-leafed laurel, which is much smaller, with darker, smaller flowers, is known as lambkill, sheep-poison, etc., showing that its dangerous qualities are suspected.

HUCKLEBERRIES

There is a group of relations of these gorgeous shrubs that are very plain in appearance, crowded with little drooping white or rose-flushed, bell-shaped flowers, that, in one case, at least, fairly tinkle when the bush is gently shaken. Whortleberries, some of them are called in Europe, or bilberries, but in America we lump several kinds under the name blueberry or huckleberry, having a vague intention of calling by the first name those that are blue, with a waxen bloom like a grape, and the shining black fruit by the other. Where these berries grow at all they usually grow in great patches, and many women and children in the country earn many dollars each year by picking and selling the little berries, that are so crowded on the branches that they may be plucked in handfuls.

THE STRIPED MAPLE

The striped maple is one of the most charming of our smaller trees, both in flower and fruit. Its buds afford a food for large deer. It is uncommon and often-est found in the thickets of rocky hillsides.

THE BARBERRY

The common barberry bushes are not native, having come here from Europe, but there is a different American species growing in the Alleghanies. The inner bark furnishes a yellow dye.

THE BUTTERNUT

The butternut is nearly related to the black walnut, and gives one of the largest and richest of our nuts, whose shells furnished the colonial yellowish-brown dye called "butternut."

THE HUCKLEBERRY

The common blueberries, or huckleberries, grow thickly on low, still, branching bushes the berries appearing soon after the flowers. The leaves, in autumn, take on very pretty lines of scarlet.

The Indians (as well as the bears) knew how good they were, and put them into their porridge, or into the corn-cakes they baked by the camp-fire. But huckleberries now are almost as seldom cultivated as they were when Indians roamed all over the rocky hillsides and sandy plains where they grew. In certain districts, however, large tracts are taken care of, and burned over very early in spring every two or three years. This kills small trees and weeds among the low blueberry bushes, which grow very quickly, and bear their best crop the year after they are burned over.

THE RED CHERRY

The Indians probably could not get much comfort out of the wild red cherries, for the flesh is very thin and very sour, but birds gorge themselves upon the plentiful, scarlet fruit, and at least one little animal, the gay chipmunk, nibbles away at them wherever it can reach the clusters of fruit. When in flower, this slender little tree of our rocky woods is wreathed in a veil of tiny, star-like, snow-white blossoms. It would be well to regard this cherry with some suspicions, for the leaves of the more common black cherry, with racemes of fragrant flowers and of shining black fruit, are very dangerous to cattle (when partly wilted, especially), and it is probable that the other species would be equally so. And children should not swallow cherry seeds of any kind, for concealed in them is a wonderfully active and prompt poison, *prussic-acid*, which may be set free in the stomach. It gives the pits the taste and odour of bitter almonds.

THE BUTTERNUT

Blooming under the wild, red cherry, are the straggling bushes of the choke-cherry, from which hang long clusters of luscious looking, scarlet berries, which will pucker the mouth and throat most amazingly. And near them will spring the butternut, which shoots up into one of the handsomest of forest trees. It is not often that one can reach the furred twigs, with their sticky half-opened leaves composed of many pairs of long pointed leaflets, and an odd bud at the tip; whence, in early spring, hang tassels of the stamen-bearing flowers, like green catkins. Other flowers hold the pistils, ready to catch pollen; and long afterwards these flowers develop into nuts with sweet, rich kernels encased in a stony shell, protected by ridges with jagged edges; and, when they drop from the tree, wrapped outside in a sticky and leathery envelope. This is green at first, but soon turns brown and stains the fingers. These green "shucks" furnished the butternut-brown dye of the colonists. Before that, we are told, Indians smashed the kernels and stirred them in water, making a buttery liquid, from which the name arose. The tree is also called the white walnut, from its likeness to its cousin, the famous black walnut, but its wood is soft and light and much paler in colour than that of the black walnut, although it looks like it when stained properly, and is frequently used for finishing rooms, making furniture and other cabinet-work.

THE STRIPED MAPLE

We are all familiar with the great maples, so often planted as shade-trees, such as the scarlet, the sugar and the Norwegian kinds; but there is a delicate little maple that we rarely see, unless we travel on the mountains or in the northern forests. It is uncommon, even then, outside of the woods themselves. It seems to be happy only in thickets of low trees covering rocky hillsides. In the north woods the hunters know it as moosewood, for those great deer, the moose, feed upon its large red-scaled buds. The other name of striped maple is quite apt, for its smooth dark-green bark is lined up and down with delicate tracings of a white pigment that can be scraped off with the nail. It is a tree that Japanese artists would like to draw, for its great, soft, triple-pointed leaves, are arranged in a fine spray, and from the twigs swing delicate pendent clusters of pale yellow bells, like fragments of necklaces; and, late in summer, follow strings of pale-brown winged fruits that turn to gold when the rays of the setting sun strikes through them.

FLOWERING DOGWOOD

In the same woods as well as those farther south, and very widely distributed, are the dogwood trees, the name

WILD CHERRY

Birds are exceedingly fond of the small tart drupes of this tree, common in rocky woods. Its delicate white flowers are borne in great profusion in early spring.

ROUND-LEAVED DOGWOOD

This shrub grows in rocky, shaded woods, where its small, white flowers in clusters are effectively set off by the pale round leaves. The fruits are light blue.

THORN-APPLES

The thorn-apples are not properly shrubs, since the rank branches are killed each winter. The small, black seeds that slip out of the ripe fruit are poisonous. It is also called Jimson-weed.

TRAILING ARBUTUS

This evergreen shrub is often called May-flower or May-pink. It is also known as gravel-plant on account of certain curative powers it possesses. It grows in sandy soil. One of the first spring flowers.

being borrowed from a European small tree, closely related to it, from whose bark a healing wash for dogs used to be extracted. In May they become snowy banks of bloom, but each apparent blossom is masquerading in a white domino. In the centre of the large white petals — as those who are not botanists very naturally call them — which form the domino, are grouped the maskers or real flowers, each quite complete in itself, — a pale somewhat slender floweret, four-parted at the margin. The snowy, striking, heart-shaped leaves we have called petals, are really "bracts" (a form of leaf that enfolds, or closely attends a flower) which cover the flowers in the little square buds. At that time they are quite green, but gradually become white as they unfold and expand. They serve to attract insects by making the tiny flowers very conspicuous, and also provide a platform upon which flying creatures may alight, so that they may search easily for, and suck up, the nectar from the very bottom of the yellow flower-vases.

If we wish to see how the dogwood flowers would look without their brilliant bracts, we may search in thickets or in woods, for other varieties, mostly low shrubs. Some of them are quite common along roadsides, while others, and, especially, the round-leaved dogwood, prefer shady and rocky woodlands. The latter has a flat-topped cluster of starry flowers, a little larger than those of the flowering dogwood, and quite white, but it has no brilliant bracts.

THE BARBERRY

Along roadsides we may find the barberry, a tall bush, very straggling in its growth and crowded by a host of suckers. It has come from the Old World, but has become so much at home here that we forget that fact. It throws out long, slender and brittle branches, studded with tufts of small, obovate or spatulate leaves; but as soon as we pick a spray we discover that it is very fully armed with sharp spines that point in every direction, and are leaves that have been transformed entirely into spines like those of the cactuses. In fall the ordinary foliage falls off, but the spiny leaves remain, ready to keep browsing animals away from the tender, growing twigs.

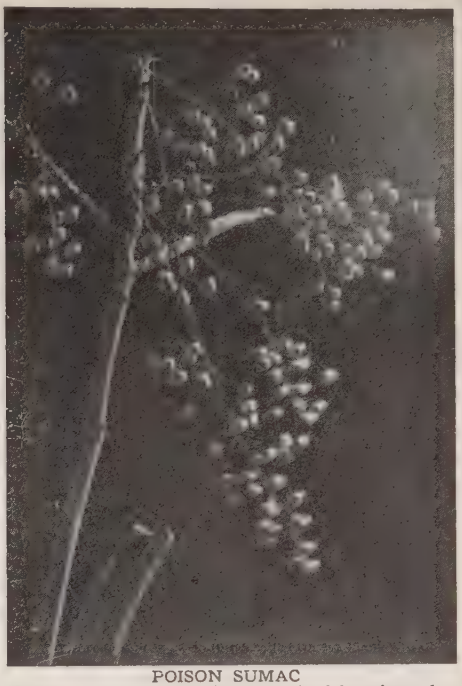
Racemes of pretty yellow flowers droop from the tiny barberry shoots in spring, in which the nectar is produced in saffron-coloured swellings, on the petals, and also on the filaments of the interior circle of stamens; for the six pollen-bearers stand in two whorls, slanting outwards and lying in the concave faces of the similarly-placed petals. The bases of these stamens are very sensitive, and when a bee flies upward to the drooping flower — that, like a roof, protects its stamens from rain — and plunges her feet or proboscis therein, seeking honey, she sets off a trap, as it were. The stamens fly upwards at the slightest touch, toward the stigma, and tap the bee smartly on the head, snapping open the little trap-doors at the top of the anther, and powdering the visitor thoroughly with pollen. The later racemes of oval scarlet berries droop from the bending branches during almost the whole winter. They are very acid, — too tart to interest many birds. But they make delicious preserves, with a very distinct flavour.

THE TULIP-TREE

Of all the great trees of the north, the tulip-tree has perhaps the largest and most brilliant blossom and the quaintest foliage. The latter has not changed much since the days when leaves were falling from pre-historic tulip-trees to be gradually encased in mud and petrified. They are somewhat square in outline, pale, ever-quivering on slender petioles, and have a deep notch cut out of the end. The flowers are upheld on the tips of the branchlets, like yellowish green tulips, with a dash of rich orange flaming upwards from the base of each of the six petals. In the fall the winged seeds stand closely overlapping in pale-brown cone-shaped groups. When they are ripe, the tips of the scales spring outwards, forming a sort of bristly cup, and high winds wrench them off, and send them spinning to earth. The tulip-tree is famous for the perfectly regular conical shape it assumes, when allowed light and room, and for its regular and straight shaft, often over a hundred feet in height. The wood is very valuable, as

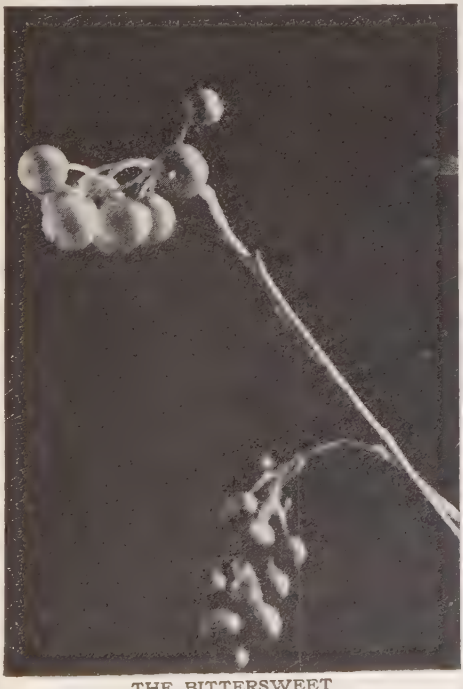
POISON-IVY

It should be remembered that the poison-ivy is likely to affect the skin even in winter, when the leaves have fallen, if the fruit or twigs be handled or bruised.



POISON SUMAC

This shrub may be easily recognised in winter by its grape-like dry clusters of white berries, and in summer by the entire-edged up-standing leaves on red stems.



THE BITTERSWEET

There are two vines called bittersweet. This one, with scarlet and orange berries, is quite harmless, although the other is considered poisonous. The berries catch the eyes of the birds and are carried afield.

THE AZALEA

Azalea flowers of different varieties resemble one another very much. The pinxter flower blooms before the leaves are fully expanded, but the white azalea is set off by fully grown leaves.

it is soft and strong, and easily worked. Indians made dug-out canoes from the trunks.

THE LOCUST-TREE

The tulip-tree grows best in damp soil but the locust-tree thrives best in dry and sandy land. It has a somewhat tropical look, reminding one of the African mimosas, for its leaves are divided into many rounded leaflets. Its spray, seen against the sunset light, looks like delicate sea-weed, and the tree itself, when uninjured, suggests instantly the gray-tinted ones seen in the landscapes of the older French painters, or of Corot; or, to use a more commonplace comparison, like quaint old pencil-drawings. However, the flowering locust is rarely seen in fine condition, for its branches are extremely brittle, are usually injured by borers, and some are apt to crash down in every storm. In June it is a glory of bloom. Great clusters of racemes of pea-like flowers droop from every branch, white, with golden hearts, an American rival of the Japanese wistaria with the added virtue of very great fragrance.

But one must approach the tree with caution, for it is defended by vicious thorns, while stray thorns are scattered here and there on the main trunk, even near the ground, where we do not expect them. Brittle as the branches are, the wood, when properly seasoned, withstands decay admirably, especially when in contact with the soil, and is greatly sought for fence-posts.

Even more tropical in appearance than the locust is the stag-horn sumac with its crooked branches covered with thick soft hair, not unlike the velvet of a young deer's horn. Its closely-set, pyramidal masses of acid fruits are also wrapped in crimson plush, as well they may be, for they crown the awkward brittle stems until spring, or as long as the birds will let them stay. Although sour and dry and velvety and difficult to swallow, they offer a sort of hard, unnourishing food to many a bird hard-pressed by hunger in the winter season. Chickadees fairly haunt them, and cheerily peck the pyramids to pieces.

POISON SUMAC

The crimson fruit, and the saw-edges of the somewhat furry leaves (formerly used in tanning), distinguish the stag-horn sumac, which is harmless, from some very bad relations which are not. The worst of them, the swamp sumac, is a tiny shrub with gray bark, which grows in very wet swamps. Its leaflets are smooth and shining, with uncut edges, and point upwards, at an angle, from the scarlet petioles. When they have fallen, after turning to a most brilliant scarlet colour, we find thickly set, grape-like clusters of small, white dry fruits, that look as if they were made of paper, hanging from the ends of all the branches. Tempting as they are to us when we are gathering winter bouquets, we must let them severely alone, just as we must let the pretty foliage alone in summer; for at all seasons of the year, to most people, the shrub is extremely dangerous. When bruised, even slightly, the leaves, stem or fruit, touching the skin, cause a dreadful, itching eruption which is apt to spread all over the body and torture one for several weeks. Even the flying pollen causes this trouble, and sumac, burned in a bonfire, will poison one standing in its smoke rather more readily than in any other way.

POISON-IVY

Although not quite so virulent as the swamp sumac, or swamp elder, as it is sometimes called, the poison-ivy, its close relative, is quite as dangerous. It is much more common, springing up in many an old field and woodland clearing, and climbing upon roadside fences, where it thrusts out its short branches into the faces of the passers-by. It climbs by means of rootlets protruding from the bark, and each leaf is made up of three leaflets of an irregular lobed, ovate outline. The number of leaflets is to be remembered, for the poison-ivy is continually entangled, with the innocent five-leaved Virginia creeper or ampelopsis. The spreading of the poison-ivy is largely due to the birds who devour the berries eagerly, pallid, hard-shelled and unappetising as they look to us. Some of the seeds passing through the bodies of the

birds fall uninjured and proceed to sprout.

THE BITTERSWEET

A much more gaudy climbing shrub is the bittersweet, that sometimes shares the fence-posts with the poison-ivy. During the summer one hardly notices the pale vine, as it climbs by twisting its supple branches around trees and other supports. One will sometimes find small trees in a grove, with a swollen portion around which a welt or groove winds spirally. This is a sign that some vine, and usually a bittersweet, has enwrapped the growing sapling so firmly that it has nearly strangled it, and forced it to grow in an unusual manner where the vine pinches, just as one's finger swells about a tightly tied string. Shade, or the upgrowing of the tree, generally kills the vine, and leaves the sapling free, but sometimes fragments of bittersweet are embedded in the bark. In fall, the orange coloured berries of the bittersweet split into four portions, that bend backwards and leave exposed a fleshy scarlet sphere, called an aril, that covers the seeds. Scarlet and yellow placed together make each hue more brilliant, painters say, and doubtless these gaudy berries catch the eye of the birds, and are carried afield by their means, as are those of the poison-ivy.

THE THORN-APPLE

At the end of this very short list of shrubs I put the thorn-apple, for it really is not a shrub at all, since each year the stalks are laid low by frost. However, it looks so much like a great widely-branching true shrub, and it is so dangerous, that I shall speak of it here. Its unshapely, lobed, dark green leaves, rank in odour and arranged in clusters separated by long spaces of bare stem; the toughness of its branches; and above all its morning-glory-like flowers, that bloom at night, and round spiked fruit, make it easily recognised. An interloper from the tropics, it thrives very well on our dust-heaps and road-sides and grows rankly, forming thickets on the vacant lots of cities.

There are two common sorts, one bearing exquisitely white flowers; the other, blossoms with violet corollas, and having purple stems and shades in its foliage.

The thorn-apples or daturas are sometimes called Jimson-weed, a shortened form of Jamestown weed. They are so-called because certain soldiers eating its young sprouts near Jamestown, Va., in colonial times, soon became delirious and acted as if half mad. This was because, while not poisonous to the touch, the thorn-apples are narcotically poisonous when eaten. Large amounts throw the victim into a fatal stupor, but in slighter quantities induce delirium. Luckily, the fruit is not very tempting. The green, fleshy, ball-like capsules soon become dry and brown, and are thickly beset by long but not very sharp prickles. It soon splits open downwards from the top, usually into four pieces, and the thin little black seeds can be plainly seen. These are the most dangerous parts of the plant, and children should be warned not to nibble them.

It is these shrubs, growing low and in dense clusters, that form the thickets that make an attractive and sheltering border along the outskirts of the woods. They flourish in a continuous fringe by the banks of country streams, arching over the currents and reaching out on the sunny side into rounded masses of foliage. Standing upon a hill-top one can trace the winding course of streams, whose water cannot be seen at all, by the green cushiony line of bushes that marks their course. Such thickets are the favourite resort of small birds, which find among their recesses plenty of the insects or of the small fruits upon which they feed, while they feel safe among the close twigs where they cannot easily be seen by hawks or other enemies, of which birds live in constant fear when they are out in the open. Few small birds spend much of their time in the tall trees, and so they seek the thickets of shrubs.

Here, too, insects, snails and such small creatures live in the shaded soil and decaying leaves. These attract the toads, wood-frogs and turtles; and after them go snakes and various of the smaller mammals, wandering rabbits, woodchucks, raccoons, foxes and so on.

CONTINUED ON PAGE 4609

THE CONTINENT OF SOUTH AMERICA

The continent of South America contains more than seven and a half millions of square miles, and the whole of this vast expanse of the earth's surface was at one time divided between Spain and Portugal. The long line of the Andes Mountains runs from north to south, like a great dividing wall between east and west.

Lake Titicaca, the largest lake in South America, is situated more than 12,000 feet high in the Andes.

THE HISTORY OF SOUTH AMERICA

CONTINUED FROM 4392

LLAMA

THE continent of South America stretches its great length from the warm shores of the Caribbean Sea to the cluster of cold and desolate islands ending at Cape Horn. Its outline is as bold and simple as that of the other two southern continents, and in size it is very nearly twice as large as Europe.

Its shape, like that of Africa and Australia, is a very easy one to model in sand, in the manner described on page 3821. Rounded at the north, broadest a few degrees below the equator, it tapers to its extreme point much nearer the South Pole than does the most southerly point of Africa.

The mountains on the face of this vast peninsula—joined to the rest of the New World by the narrow Isthmus of Panama—are equally easy to show on a sand model, for, as we see at a glance, its great backbone of the Andes forms one mighty unbroken rampart close to the Pacific shores, from Panama to Cape Horn, for 4,500 miles.

We have already seen how the Andes, those western heights of the southern continent, are the continuation of the Rockies in the north, through Mexico and the central bridge of isthmuses. It needs some thinking to take in the immense length of the Andes chain. The little Pennines, which have so much influence on the prosperity of England, are only about 150 miles long. The Pyrenees, so important in French and Spanish history, are about twice that length. The noble arch of the snowy Himalayas is generally reckoned 1,500 miles in length. The height, too, of the Andes chain is very great, second only to those of the Himalayas and the mountains of Tibet.

From end to end, the peaks are always covered with snow, even where the sun beats down fiercely in the region of the equator. There are more than twenty peaks considerably higher than Mont Blanc, one of them being the highest volcano in the world. The highest point in the chain of snow giants is Aconcagua, nearly 23,000 feet above sea-level.

Then, again, the Andes are very wide in parts, especially towards the middle, where the coast makes a bend inwards, something like the Gulf of Guinea. Several chains run side by side, forming a triple wall, with high plateaus between them, as high as the tops of the Pyrenees, and on these plateaus, so hot at midday, so frosty at night, are lakes and the beginnings of mighty rivers.

In our sand map we can show Lake Titicaca, which is the size of Connecticut, with a piece of looking-glass laid on the sand, near the central bend of the coast, just about where the Andes are broadest. And those rivers! The position of the Andes on the extreme west of the continent gives plenty of room for great rivers to form and flow eastwards and southwards to the Atlantic Ocean.

THE RIVERS THAT RUSH DOWN ON BOTH SIDES OF THE STEEP ANDES

None of the rivers that run westwards are as long as the Hudson, though at the melting of the snows the vast number of streams dash as torrents down the steep slopes and over the dry and narrow coast plain to join the mighty Pacific. But, looking eastwards, there is a vast difference. The streams gather, as they do in the high Alps, and come tumbling and foaming down from the plateaus and upper valleys, till they reach the bottom of the mountain slope. They then roll steadily on, getting ever larger and larger, across the boundless plains to the far distant Atlantic.

"Across a continent in a boat" sounds almost as impossible as "across the sea in a motor-car," when we think of every other continent; but such a voyage is almost possible in South America, where the sources of the mighty Amazon rise less than 200 miles from the Pacific coast, and when once the stream has settled down to a steady flow at the foot of the mountains, it is navigable for large steamers right away to its immense mouth, 3,000 miles across the plains.

Many of its great tributaries are navigable, too, for hundreds of miles. Its width is most imposing. When it enters the great plain it is half a mile broad, increasing in different parts of its long course to a mile, two miles, four miles, and to fifty miles at its mouth. The water of the Amazon is fresh enough to drink 180 miles from the coast, and is distinguishable from the ocean by its colour.

A BRITISH GUN-BOAT THAT STEAMED ALMOST ACROSS SOUTH AMERICA

A British gun-boat has lately steamed right across the continent to Iquitos by this "Mediterranean of South America," as the Amazon is sometimes called, affording as it does by its broad and deep main stream, its tributaries and scores of lakes, more inland navigation than any other river in the world. The Father of Waters, the Mississippi-Missouri, is reckoned to be nearly 1,000 miles longer than the Amazon or the Nile, but the Amazon drains twice as much country as either river.

As we place the strands of string or wool to show the Amazon's course on our sand map, let us reflect that this course is just south of the equator, that most of the country is taken up with vast tropical forests, where wonderful trees, palms, tree-ferns, rubber, mahogany, and many others, such as we see in single specimens in the tropical houses at Bronx Park, grow in the greatest luxuriance and profusion, thickly bound together with creepers whose beauty would make our finest clematis and honeysuckles look like weeds.

And these thick, dark, damp, hot forests are the natural home of many of the animals we shut up in cages in our zoos. The terrible boa-constrictor and many other snakes wind their horrid scaly bodies round the tree-trunks, waiting for their prey to come within reach; the chattering monkeys swing freely from branch to branch, as if engaged in an endless gymnastic display.

THE MONKEYS THAT BRING THEIR FAMILIES TO BATHE IN THE MIGHTY AMAZON

It is a very pretty sight to see the mother monkeys bring their babies down from the tree-top to have a morning toilet and bath by the river. The toucan, with its great bill, that deafens us at the zoo, here out-screams even the monkeys, and the gorgeous parrots of nearly every colour—plaid parrots, a little girl called them—make their share of noise as they fly hither and thither.

The only quiet folk seem the dainty, tiny humming-birds, that dart swiftly about in the flickering shade and sunlight, some as small as bees, others the size of a wren. We can study these in the cases in the Natural History Museum in any of our large cities, as well as many other specimens, ranging from alligators to birds of paradise, that dwell in the vast forest basin of the Amazon. One of the noblest explorers, Wallace, spent years in travelling about the waters of the Amazon, and studying all the wonderful life that is to be found in the forests. There is also rich vegetation, in summer, in the basin of the Orinoco, a great river about as long as the

NATURE'S MAJESTY IN THE NEW WORLD

Here we see the strait of Magellan, between the southern point of South America and the island of Tierra del Fuego. It was discovered by Magellan, in 1520, when he sailed the first voyage ever made round the world.

The Amazon is the greatest river in the world, and its name is from a native word meaning boat-destroyer. It is more than 3,000 miles long and 50 miles wide at its mouth, and its fresh water rushes out 200 miles into the sea. Here we see the mighty river where it starts as a tiny stream away up in the Andes.

Nature provides some majestic scenery in South America. Mountains and rivers are at their grandest in this vast land, and here we see a wonderful waterfall in the Argentine Republic known as the Iquazu Falls.

Zambesi, which drains eastwards across the north of South America. Here can be seen miles of the great water-lily called the Victoria Regia, which also grows on the Amazon. We can study its wonderful round leaves, five or six feet across, turned up at the edge, and its beautiful pink-and-white flowers, in the best of our Botanical Gardens, and picture to ourselves what it must be to see the great expanses of water covered with it.

How the fruitful plains become deserts waiting for the rain

The plains of the Orinoco River are called the Llanos. Very heavy rains visit them at times, and the rivers swell and flood the country far and near—even making it possible to pass in a canoe to the Amazon River—causing rich food to grow for vast herds of cattle and flocks of sheep. In the dry season there is a great change; hot winds scorch up the grass, the animals move away, and the land, once so moist and full of life, becomes a desert till the rain comes again. Like the Amazon, the stream of the Orinoco carries fresh water far out to sea.

The River Plate, or Silver River—Rio de la Plata—is an immense estuary, far south of that of the Amazon. Into it pour the waters of several rivers, running chiefly south and east from the Andes over bare uplands and vast and low valleys of fertile soil, and some come from the eastern heights which separate the north and south drainage. The length of this great system is reckoned to be over 2,000 miles.

North and south of the River Plate are the Pampas, wide tracts of land where animals feed and thrive in great numbers. Trees grow here chiefly by the banks of rivers, and as far as the eye can see is tall, waving grass, green all the year round. In some places, vast fields are covered with a tall, feathery grass that grows in clumps in our parks and gardens, and which we call pampas grass.

The vast plains of tall grass in which riders are out of sight

When we look at these clumps of pampas grass, we must think of this district in South America, where it grows so thickly that a horseman can scarcely be seen above the sea of fleecy white plumes, rising and falling with the breeze almost like real waves.

To the south of the Pampas, the continent, ever narrowing, becomes bare and desert for the most part, though there is fertile land at the base of the Andes. The islands at the extreme south are called Tierra del Fuego, the Land of Fire, so named, it is said, from the red colour of the soil, where the chief height is named Mount Darwin, after the famous naturalist who visited and described this bare and rocky part of the world. The Strait of Magellan, the winding rocky channel that separates the Land of Fire from the mainland, is a terrible place in which to be shipwrecked, for there is nothing to eat besides shell-fish and a few birds, and the natives are practically uncivilised.

This brings us to the question of the people who now live on this vast continent, and those who have lived on it in the past. As we finish our sand map by putting in position the rest of the highlands—insignificant indeed, as compared with the Andes—on the north and east, where they serve to guide the direction of the rivers, we think again of the great size—nearly twice as large as Europe—and find it very difficult to realise that there are not as many people now living in South America as there are in the small British Isles.

A continent of many countries without a king or queen

We shall visit these people in their homes, and enter into the wonderful progress and interests of to-day, after we have glanced at the past. But first we must study the map of to-day, showing the various countries or divisions of the continent.

The three foreign settlements of Guiana—British, Dutch, and French—lie between the mouths of the Orinoco and Amazon. All the rest of South America is divided up among ten independent republics. It is quite different in this respect from all the other continents. We shall study these divisions more closely later; now we just want to know their names and where they are.

The great Andes run through Colombia, Ecuador, Peru, Bolivia, and Chile on the west. The mighty Amazon takes its majestic way from Peru across Brazil, which touches the borders of all the countries except Chile, and is about as large as the United States and Alaska together. The Orinoco drains Venezuela; the Plate rivers bring health and

THE MAN WHO CONQUERED AN EMPIRE

The story of the Spanish conquest of Peru is a record of greed and cruelty, such as has few parallels in all history. Pizarro, the conqueror, was a man who could neither read nor write, and though he was full of courage and daring, his success was due more to treachery than to bravery. At a friendly interview he suddenly seized the Inca, or emperor, as shown here, and, after extorting a huge ransom for his life, killed him.

The empire of Peru was fabulously rich. Everywhere there was gold, and probably in no other place and at no other time has so much of the precious metal been gathered together as was collected for the Inca's ransom. It is said that the gold and jewels brought together for this purpose were worth $8 000 000. Here we see Pizarro describing the riches of Peru to the Emperor Charles V., who granted him the right to conquer the new lands.

The picture of Pizarro and Charles V. is from a photograph by Messrs. Nacoste

wealth to Argentina, and to the smaller states of Uruguay and Paraguay. We notice at once how many Spanish names are on the map; with good reason, for Spain owned nearly all South America, except Brazil, during nearly 300 years. So once more we willingly join Columbus, who discovered the West India Islands, and coasted the Gulf of Honduras and the Gulf of Darien, where the Isthmus of Panama joins the great southern continent.

THE MIRACLE COLUMBUS DISCOVERED AT THE GATES OF PARADISE

It was here that Columbus first heard rumours of another ocean, which he never saw. On his way round the southern shores of the Caribbean Sea he came to the mouth of the Orinoco, and great was his wonder at its stream of pure, drinkable water which he found so far out at sea. It was a miracle, he thought; he had, indeed, arrived at the very gates of Paradise.

Before his death, in 1506, explorers had sailed round this north coast, and discovered the delta of the Amazon. Portugal, too, in 1500, had discovered Brazil by accident, when the strong winds blew Cabral and his little fleet of ships, that were trying to sail round the Cape of Good Hope, so far westward that they reached the other side of the Atlantic. Fourteen years later La Plata was reached, and soon Balboa caught the first sight of the Pacific from Panama, and Cortes began his wonderful career in Mexico and Central America.

And so, bit by bit, the New World in its beauty loomed into the sight of the Old World, and the wonderful voyage begun by Magellan—who was the first European to push through the strait that is now called after him, into the Pacific—not only found a westward way to the Spice Islands, but a way right round the round world, hitherto believed by most people to be flat.

THE QUEST FOR GOLD THAT BROUGHT MEN TO THE NEWLY-FOUND CONTINENT

The natives whom the first explorers found in South America were called Indians by them, just as happened in other parts of the New World, and a certain amount of organising that took place in the new lands led to difficulties with the dispossessed "Indian" natives. The colonists brought over horses and cattle and poultry, hitherto unknown in the Western lands, as well as shrubs and trees and seeds for crops, which have all flourished exceedingly in their new home.

Unfortunately, rumours of vast treasures of gold and silver to be found in distant spots turned men's attention away from quietly settling down to peaceful employments and improving the country, and for long years the wild hunt for gold drew men from Europe—the Englishman Francis Drake among them—and led them round the coast, and up the rivers, in all directions, ever exploring and opening up new ground, but seldom settling down in content.

Missionaries went out from Europe to teach the Indians the Christian faith from the first; but settling down and working hard, whether in the fields or in the mines, as they were discovered, did not suit the races who had ever been free to wander over the wide plains and gain their food without effort, and the Indians became fewer and fewer in numbers as time went on.

THE ADVENTURER WHO CONQUERED A GREAT EMPIRE WITH A LITTLE ARMY

It was in 1526 that Pizarro, a bold adventurer, with great experience of the country, determined to prove for himself whether the rumours of gold, and of the existence of civilised people in the high valleys of the Andes, were true or not. The deeds of Cortes in Mexico were breathlessly exciting and daring, but those of Pizarro matched them.

It is a deeply graphic story—how he planned his expedition and equipped his little band of followers; how he dealt treacherously with the natives and with their ruler, the Inca; and how, after many difficulties and much endurance, he climbed up the mountains from the Pacific side. Like Cortes, his horses and little cannons brought amazement to those who had never seen them before. One hundred and sixty-eight Spaniards pushing into an unknown, difficult, mountainous country, of rumoured riches, civilisation, and great resources, seems a foolhardy feat indeed, but it succeeded.

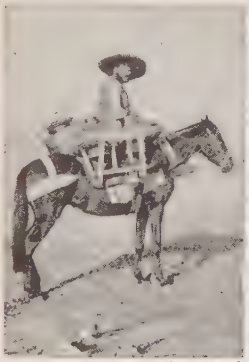
All round about Lake Titicaca and Cuzco, and the valleys and plateaus of the Central Andes, are found the remains of irrigation works, temples, palaces, and burial-places that belonged to the highly civilised people the Spaniards

THE PEOPLE OF SOUTH AMERICA

An Indian of the city of Cuzco, the ancient capital of the Incas, returning home with a bundle of fuel which he has gathered.

Indians of the Titicaca region of Bolivia dressed up in strange costumes ready to perform a native dance on a holiday festival. These dresses were once intended to frighten away evil spirits.

An Indian woman of La Paz, in Uruguay, showing the manner in which the women of those parts carry their young children.



A native Indian milkman of Brazil. In the rural parts the milkmen ride about on horseback, as shown here.

The people of Patagonia, though very muscular and able to walk tremendous distances, fall easy victims to disease. They are one of the tallest races on the earth. Here we see a woman and children wearing skins.

A native of Villa de Cura, a city of Venezuela, that suffered terribly from an earthquake in the year 1900.

Botocudo Indians of Brazil, a race of savages that live in the wilder parts of the country and have very primitive habits. They wear few clothes and use bows and arrows.

A group of llamas in Peru with an Indian driver. These animals are the principal beasts of burden in the country, and can carry heavy loads a long distance.

The photograph of llamas with their Indian driver, copyright by Underwood & Underwood, N. Y.

found when they reached Peru. These people understood well how to fertilise the soil by carrying water to it. The legends relate that the Incas, or "Rulers of the Wide-spreading Kingdom," were descended from the Sun-god. On the strength of this distinction they claimed and obtained absolute power over their subjects. The stories of their bloodless victories over their enemies, of their state and family government, of the dazzling ceremonial of their worship, of their schools, and the work of the sun-maidens, all read like wild romance.

The sun-maidens worked up the fleece of the llama, the only domestic animal in the New World before the coming of the Spaniards. It, too, was supposed to be the special property of the Incas. Like the yak of the Tibetans, it carried the burdens over the difficult hill country, its hair was made up into fine clothing, and its flesh served for food.

How the Incas destroyed the work of the men who went before them

The Incas destroyed most of the sculpture and work of the tribes that went before them, but wonderful pottery of various kinds, some dating back to very ancient times, has been found, as well as many traces of various tribes of different degrees of civilisation. We can find interesting specimens of this pottery in museums. Some of the tribes were conquered by the Incas, others lived in the far past in the north of the continent. The most interesting of these were the Chibchas.

It is difficult to get at the truth of Pizarro's conquest of the Inca kingdom. Some say the Spaniards treated these unoffending peoples with great cruelty; others that their methods were no worse than those of other conquerors. Arrived at Cuzco, the capital of the Incas, Pizarro's first anxiety was to get hold of the person of the ruling Inca, as Cortes did with Montezuma, and influence the country through him, rather than to attempt force with his few followers.

Imagine the scene in the high country, among the inaccessible snowy peaks. Pizarro boldly sends an invitation by his horsemen to the Inca, to request the honour of a visit, in the name of his master, Charles the Fifth, ruler of a great part of Europe. The Spaniards have an anxious day, watching and waiting to see if the invitation will be accepted. Great is Pizarro's relief when he sees the Inca's train setting out in his direction. The great ruler, on a litter, has to listen to a long speech, through interpreters, beginning with the creation of the world, and setting forth, with various references to the Bible, how the Pope has given the kingdom of the Incas to the Spaniards.

The capture of the Inca and the treachery of the Spaniards

It must have been sufficiently bewildering to the Inca, and he asks to see the Bible, the wonderful book that ordered so much. When he impatiently throws it down, it is as a signal for the uprising of the waiting Spaniards.

The daring scheme succeeded. It is said that 2,000 Peruvians were killed that day; the Inca was made prisoner, and the country was left open to the Spaniards at one blow.

There were many things that helped on their complete victory in the state of the Inca kingdom itself, especially the quarrel between the brothers as to who was the rightful Inca.

For a time the subjection of provinces went on successfully, and we hear of a roomful of silver and gold, as high as a man could reach, being handed over to the Spaniards.

But in the end both the brothers were put to death, and before long civil war broke out among the conquerors. Pizarro himself was assassinated in 1541, in Lima, the new capital he had founded by the sea coast. On the ruins of the Inca kingdom rose the huge vice-royalty of Peru, which included the present republics of Ecuador, Peru, Bolivia, and Argentina.

The men who sought in vain for a city paved with gold

Though much treasure had been sent home to Spain from the Inca's palaces, the hunting for the sources of these spoils continued to be the great object all through the sixteenth century. The first explorers had passed all unknowingly the great mines of Potosi. By degrees many mines came to their knowledge, which needed much hard labour to work. Search as they would, they could never find the city paved with gold, nor the Golden Man who washed off his coat of gold dust in a sacred lake into which were cast priceless treasures.

Many were the gold-hunting expeditions, which served, as the earlier ones had done, to open up more and more of the country. There was Mendoza, who, in 1535, sailed down the Atlantic coast and founded the first colony of Buenos Ayres, which means "Good Air." Great were the discouragements, and his followers went farther inland, led by great rivers, to found Santa Cruz, a station for trade midway between the Atlantic and Peru.

How fifty sick men floated across a continent on rafts

In Paraguay the 2,000 men in Mendoza's expedition were specially friendly with the natives, and intermarried with them.

More interesting still is the account of fifty sick and weak men floating across the continent on rafts—led by Orellana. They failed to keep in touch with the stronger members of the party, who were marching on the banks on the way from Quito to Rio Napo, which leads to the Amazon. So Orellana and his men could do nothing but let the rafts drift on, day after day, through the forests and its enchanting wonders, getting what food they could, till, in seven months' time, they reached the ocean, and a little farther north, to their joy, was a European settlement.

The Amazon has been described as having become a permanent public road in the century after this raft journey; it was chiefly used by the missionaries, who thought no dangers too hard when seeking for the Indians.

The quest for gold in the little Venice beyond the seas

Much searching for gold continued in the north, in Venezuela—the name, Little Venice, being suggested by the native lake-dwellings—as well as in Brazil and along the Andes range. Rich as are the stores of gold, silver, and precious stones, such as diamonds and emeralds, in various parts of South America, they are not even yet fully worked and made the most of.

One of the most tragic expeditions was that of the gallant Raleigh, searching for a gold-mine on the Orinoco.

As the feverish quest for gold died down, the organisation and settlement of the colonies proceeded more rapidly. Governors were sent out from Spain for the various provinces, and also many clergy, and matters went on much the same as in Mexico and Central America. Almost from the beginning the difficulty of obtaining labourers led to the wretched practice of making the Indians slaves on one pretext or another, and when the supply of the natives failed, negroes from Africa were taken across the Atlantic to fill their places, especially in the sugar plantations round the Caribbean shores.

Through the seventeenth and eighteenth centuries the trade of Spain and her colonies grew steadily, and Buenos Ayres, on the Plate, and Para, the port of the Amazon, Cartagena, on the Caribbean Sea, and other towns grew to be very important. Spain also encouraged scientific men, such as Humboldt, to make surveys of the coast and the surface of the country, and to examine the minerals, flowers, trees, and animals. When we visit Madrid we can see the result of these studies in the fine collections exhibited in the museums and in the beautiful botanical gardens.

The revolution that freed south america from the yoke of spain

The provinces of Spanish South America took part in the general uprising against the control of the distant motherland when new notions of freedom were making themselves felt all over Europe and America, as we read in the story of Mexico, beginning on page 4381. The rule of the Spaniards was thrown off early last century, after a war of independence which lasted several years. Both the Royalist Spaniards and the Liberator patriots were terribly in earnest.

The battle of Trafalgar and the schemes of Napoleon in Spain and Portugal, about which we read on page 3360, all influenced the uneasy state of public feeling. There were many causes for discontent. The Creoles, or colonists born in America, felt it keenly that all the most important posts were given to men born in Spain; and, owing to one reason and another, the flames of revolution broke out in province after province, with varying success. The English took a part whenever the chances of war allowed. It was by no means a straightforward struggle, for civil wars began between the patriots just when a united front was most urgently needed. Differences

of opinion as to what form of government should replace that of Spain also occurred. It was a terrible hindrance to the Liberators that some of the leaders, enthusiastic as they might be for freedom, thought most of their own personal rewards and success. This was particularly the case with the great Bolivar, who led as eventful a life in South America as Santa Anna in Mexico.

THE GREAT BOLIVAR, WHO DROVE OUT THE SPANIARDS AND FOUNDED A REPUBLIC

There is a grand statue of Bolivar on a prancing horse in the city of Lima, to keep in remembrance his great share in liberating his country. He chiefly turned his efforts to the freeing of the north, and secured that Venezuela, New Granada, and Quito should be formed into one Republic called Colombia, of which he became first President.

San Martin was a great and noble general, and a true patriot. He had fought bravely in the Peninsular War, when England helped the Spaniards against the French, and he brought much experience to bear when he was needed to take command in the struggle to free his country. He knew when it was right to advance rapidly, or when he must, like Wellington, play a waiting game. He won many great victories, and set free Chile and Peru.

At last all the sieges, and marches, and terrible loss of life in the years of war, came to an end after some decisive victories of the ambitious Bolivar over the Spaniards. Their last possession on the mainland, the seaport town of Callao, near Lima, was lost in 1826.

HOW PORTUGAL LOST BRAZIL FOR EVER, AFTER WINNING IT BACK FROM SPAIN

Brazil had been seized from the Portuguese about 1580 by Philip of Spain, and his enemies, the Dutch, attacked his power and held their own in the distant province till the Portuguese were able to claim their own again in the seventeenth century. We know how the Royal Family and Court fled from Lisbon to Brazil when Napoleon threatened Portugal. From this event is dated the rise of the beautiful capital of Rio de Janeiro. We have seen, too, how a Brazilian empire was formed when the government returned to Europe fourteen years later. A republic followed in Brazil in 1889.

There were many disputes, chiefly about boundaries, in the years that followed the departure of the Spanish governors, and there were many changes in the new republics. But these are now settling down and awaking in a wonderful way, as we shall see in our story of South America of To-day.

As we look in imagination over the long past of South America, we see it first in possession of the old tribes, some of whom, thousands of years ago, used the vessels we can handle to-day. For long centuries their descendants wandered over the wide country, living their primitive lives. Then, out of the mists of time, we distinguish the dazzling Incas with their high civilisation, living in the mountain districts and on the Pacific coast, and leaving many traces by which later generations could study their work and their ways. And we see this civilisation all brought to a sudden and tragic end as the white men from an unknown eastern world swarmed over the sea which had hidden them so long, to seize the lands and treasures of the unfortunate Incas.

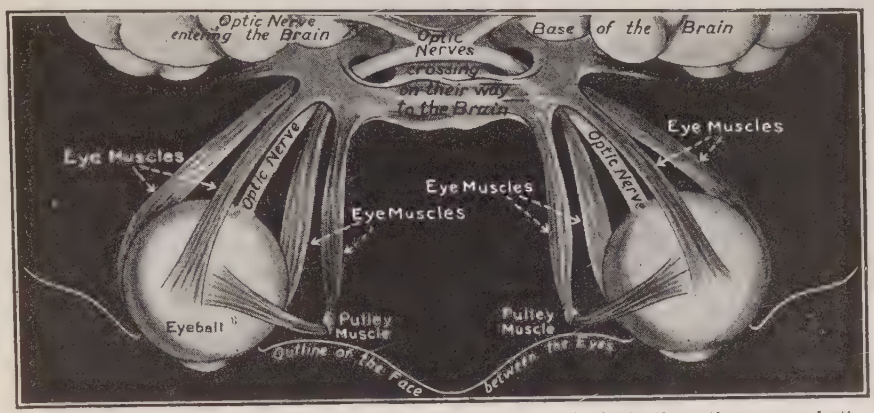
THE CENTURIES OF TRAGEDY BEFORE FREEDOM CAME TO SOUTH AMERICA

We see Spain and Portugal in possession of the continent for nearly 300 years; explorers seeking gold up the wide rivers, through the great forests, over the dangerous passes of the Andes; and the black-frocked priests in their wake, many of whom were ready to lay down their lives in their efforts to teach the Indians, whom their countrymen were ever ready to enslave. What a passing, too, of ships in those years over the Atlantic after Columbus showed the way! Among them were the treasure-ships from Cartagena, so often waylaid by English pirates; the colonists from Europe going, and sometimes returning; the poor negro slaves, torn from their homes, for whom there was no return, no release but death.

The next vision is that of the fiery times of revolution and suffering, for the Royalist Spaniards, for the Creoles of the colonies, for the people of mixed Spanish and Indian blood, for the Indians themselves, descendants of the old owners of the soil.

But the strenuous struggle, the smoke of battle, and pitiful horrors of war in all its aspects, have led to freedom.

The next story of Countries is on page 4567.



This picture helps us to understand how the eyes grow out of the brain, the optic nerve projecting till it expands into the hollow cup of the eyeball. The muscles that move the eyes are also shown.

SEEING COLOURS

CONTINUED FROM 4406

IN some ways, the most wonderful of all the feats that the eye performs is the seeing of colours, and this subject of colour vision, as it is usually called, is also very important from the practical point of view, because in many cases we require to distinguish one colour from another; and sometimes the lives of many people may depend upon the certainty with which this is done.

We know that light is a wave motion in the ether. A better way of putting it would be that there are wave motions in the ether which, when they fall upon an eye, give rise to light. Apart from eyes to see, all Nature is in darkness. Neither the eye nor the ether alone can make light, but both are required. We can count the number of vibrations of the ether that affect the eye in a single second.

The smallest number per second that we can see is roughly about four hundred billions. When we see these we get an impression of red. The highest number we can see is roughly about eight hundred billions, and when such vibrations affect our eyes we see a sort of violet.

Now, in music, a note that is an octave higher than another has exactly twice the number of vibrations in a second; and so we may say that the amount of light that our eyes can see corresponds to one octave, the number of vibrations of the violet being about twice the number of the red. We must clearly remind ourselves once more that just as there are sounds higher and lower in pitch than the eleven octaves or so which we can hear, so there are ether vibrations higher and lower in pitch than the one octave or so that we can see.

We know that our distinguishing of colours depends upon the cones in the retina. We are bound to suppose that in those kinds of eyes where there are only rods, colours cannot be distinguished as they are seen by us; and we begin to understand the immense advantage of having a place in our eyes which is the most sensitive of all, and contains only cones.

From all this it follows that we do not see the colours of objects whose light falls upon the outermost parts of the retina, where there are no cones, or practically none. Also our eyes vary in sensitiveness at different parts of the colour scale. At the actual extremes, such as red and blue, we do not notice slight differences in colour so sharply as we do in between the extremes, as in the yellow and green.

Colours vary in several ways. For instance, they vary in brightness, as we all know. The brightness of a colour depends simply upon the extent to which it excites the brain. We cannot say why one colour, because it is that colour, should affect the brain more than another; but it is so.

Secondly, we find that colours vary in their hue, or tint, and that depends on the number of vibrations in each second of the ether waves which cause the colour.

Thirdly, colours vary very much in what is called purity, or richness. The best types of eyes are very keen to appreciate this quality in colours. A pure colour is one which depends upon light of one rate of vibration. The purity of a colour is destroyed when it is mixed with other colours, or when it is mixed with white light, which really comes to the same thing, as white light contains all the colours.

THE MYRIADS OF COLOURS THAT WE CANNOT SEE AT ALL

Now, quite apart from any question of the eyes, the question of colour is simple, because it is exactly the same as the question of the pitch of sounds. Ten vibrations a second means one sound, eleven means another, twelve another, and so on; or there might be twelve and a half, and that would be a sound of still another pitch. In the same way, between light made of waves running four hundred billions to the second and light made up of waves running eight hundred billions to the second there is really an infinite number of colours—hundreds of billions of colours. That is all very well, but when it comes to our seeing them we find that the case is different.

If we take white light and pass it through a prism, we get a band of colours called the spectrum, and when we look at it we quite clearly get the impression not of a regular even change of colour from one end to the other, but of comparatively few colours to which we give definite names. Of these various colours, which are commonly described as seven, some give us the impression of being mixed, and others of being pure. For instance, the colour we call purple is mixed, because, when we come to consider it, we see that what we call purple is really the result of our seeing a blue and a red together. What we call orange is mixed; what we are really seeing is a red and a yellow together. Then, again, Prussian blue is not a pure blue, but a mixture of blue and green.

THE THREE PURE COLOURS THAT ARE NOT MADE UP OF OTHER COLOURS

Now contrast with these colours such a colour as crimson red. Nothing will persuade us that that is a mixture of other colours; it is simply red itself. There is also a tone of green which we cannot imagine to be made up of anything else, and the same is true of ultramarine blue. Probably these are the only three colours of which this can be said. We therefore call red, green, and blue primary colours. The meaning of this is almost always misunderstood.

When we call red, green, and blue primary colours, we are not saying anything about light; we are talking about the way in which the eye sees. Light consists of waves of every rate of vibration, and any one of these rates is as good as another. But the eye, instead of being able to see each of these, has only got within itself means for seeing three of them directly, and these three are red, green, and blue.

All the other colours it sees by mixing in various proportions these three kinds of sensation, and that is why we call red, green, and blue primary colours. By mixing these in various ways we can obtain the impression upon the eye of every kind of colour that it can see. By mixing red and green rays in various proportions we can get the effect of all the scarlets, oranges, yellows, and yellow-greens; by mixing red and blue rays we can get all the various violets and purples; and by mixing the green and blue rays we can obtain all the various shades of blue-green.

To the three primary colours we have to add a fourth—the grey colour which we get from the rods of the retina. We read about this on page 4405.

A POWER THAT NO MAN UNDERSTANDS, BY WHICH WE SEE DIFFERENT COLOURS

Of course, we now want to know what are the things in the eye which correspond to these various kinds of colour sensation. This can be clearly answered as regards the grey colour, for we know that that is due to the rods. We know also that the cones are responsible for the other three kinds of colour

sensation; but, unfortunately, we can go no farther than this, except by guessing. For instance, we do not find that there are three different sorts of cones, nor do we find, as some have supposed, that there are three different parts to each cone—one for each kind of colour.

Nor can we show that there are three different kinds of nerves running from the retina to the brain, as Dr. Young supposed a century ago. It may, indeed, be that we are altogether mistaken in looking at the retina for the key to the fact that we see colours by these three sensations. It may be that the key to the facts is to be found not in the retina at all, but in the grey matter of the vision part of the brain. The fact that a man may be colour-blind in one eye is rather against this.

As a rule, colour-blindness occurs in both eyes, but there are cases where it is found in one eye only, and that, of course, suggests that it is the eye rather than the brain that is responsible for colour vision. Colour-blindness is almost always a state of things which exists from birth, and there is no cure for it.

People who could not see the colour pictures in this book

About four men out of a hundred, it is said, have one form or other of colour-blindness, and about one woman in a hundred. This is by no means the only case in which peculiarities are found more commonly in men than in women. Colour-blindness is passed on from parents to children, and we have lately gone far to understand the laws by which it is inherited.

Very rarely we find people who are quite colour-blind. The spectrum of sunlight to them appears in shades of grey throughout, being lightest in the position of yellow-green, and darkest at each end. A coloured picture to them looks like a photograph or an engraving. If we believe that our three colour sensations depend on the presence of three special chemical substances in the retina, then we must suppose that in such cases all these three substances are absent.

Very rare also is "blue-blindness," in which the possibility of blue sensation is absent. Then there is "green-blindness," common, and very important, in which we suppose that the substance corresponding to the green sensation is absent; in such cases bright green is confused with dark red, and a dark green letter on a black background is not seen at all. If we remember that everywhere on railways red is used as the colour of danger, while green allows the driver to go on, we shall understand how very serious it would be if a railway signalman could not distinguish between a bright green colour and a dark red colour.

Why railway signals are always red, green, and white

Lastly, there is "red-blindness," also common, which is sometimes called Daltonism, because it was this that Dalton suffered from. Here we suppose that the chemical substance affected by light and corresponding to red sensation is absent from the retina. In these cases light red is confused with dark green, and a dark red letter on a black background is not recognised at all.

Now, as nearly all colour-blind men are either red-blind or green-blind, it was suggested that signal colours, instead of being red, green, and white, should be changed; for instance, blue and yellow might be employed. But this does not do. The only convenient colours to use for this purpose are red, green, and white.

It is found that a red glass allows about ten per cent. of the light behind it to come through, and a green glass rather more, but a blue glass allows only about 4 per cent. of the light to come through; and yellow does not do, for there are states of the light in which yellow would not be noticed.

It is necessary, then, to test people who are to be expected to recognise lights, and if they are colour-blind they must find some other employment. Even now, although there has been a great deal of discussion about it, both seamen and railwaymen are not looked after carefully enough in this respect.

The best way of finding out if we are colour-blind

Scores of different methods have been invented for detecting colour-blindness. The best method, which is generally employed, is the use of coloured worsteds, and the person who is being tested is asked to match them. If a green-blind man is handed a skein of pale green worsted, and if he draws

from the heap some worsteds which contain no green at all, then he must not be passed; or if a man takes a dark green as a mateh to a dark red skein, he proves himself to be red-blind, and must therefore be rejected.

HOW WE CAN REST OUR EYES BY LOOKING AT THINGS A LONG WAY OFF

Enough has already been said about spectacles and their importance in correcting the errors of refraction. Here we must note a few points which will help us to preserve our eyes, quite apart from the use of spectacles.

When the muscles inside the normal eye are at rest, the shape of the lens and other parts is such that the eye is fitted to see distant objects. There can be no doubt that the first and most natural uses of the eye are for distant and not for near vision. The course of our lives is now such that we use our eyes very much at short distances, and this means the use of the muscles inside them. That is especially true of long-sighted persons, who should, of course, not use their eyes at short distances without glasses. But, apart from that, it is a good rule for all of us to relax our eyes, when we can, by letting them rest upon something which is distant, and so giving the muscles inside them a rest, and lessening the risk of strain.

The best light for vision is daylight—not direct sunlight, but diffused daylight reflected from the sky. When we use artificial light, which we do more and more, it is a safe rule that the nearer it resembles diffused daylight, the better it will be. When we call daylight diffused, what we mean is that it comes from a large surface—the general surface of the sky. What we call a soft light is always one that is diffused in this way. Other things being equal, the larger the surface from which the light comes to our eyes, the softer it is, as Lord Rayleigh pointed out a good many years ago.

THE BEST WAY TO LIGHT OUR HOUSES AND TO PAPER OUR ROOMS

In modern buildings the lights themselves should be entirely hidden, and we should see by light reflected from wall or ceiling. Of course, this is expensive, because more light is required; but, though it costs more money, it saves our eyes very much.

Another great fact about diffused daylight is that it is steady, and so should artificial light be. In this respect gas is a great improvement upon candles, and electric light is the best of all.

It has lately been shown by some French students that the different qualities of light affect our eyes in different ways, quite apart from their brightness. The safe rule is that we should, as far as possible, make our artificial light of the same composition as sunlight.

In our houses, if we are wise, we shall have spaces upon which the eyes can rest. This means that we shall think twice before we use wall-papers with marked patterns; this is true especially of bedrooms, because, sooner or later, someone is likely to lie ill in a bedroom, and, whatever healthy people can stand, wall-papers with patterns are a distress and a nightmare to sick people.

THE SAFE RULE FOR READING BY DAY AND NIGHT

Great stretches of Nature are green. There is probably no colour which fatigues the eye less in proportion to its brightness than the green of fresh young leaves. This is good for bedrooms and living rooms alike. Dead white is fatiguing to the eyes, and best avoided. It is excessively foolish to read with the eyes facing a source of light, especially as the light is anything but diffused. We should read with the light behind us, passing over one shoulder or the other—the left shoulder, of course, when we are writing.

So far as children are concerned, we must remember that the great majority of them are long-sighted when they are very young, and that therefore the strain of using their eyes at short distances is even greater for them than for us. The fact that the child is long-sighted ought to be hint enough to us that the best employment for its eyes at early ages is not at short distances. Few and short stretches of reading and writing are all that we ought to require of these young eyes. On the whole, the best work for a small child is its play, and its best play is open-air play with balls and hoops, and so on.

When we *do* set children to read, we must remember that we are taking certain risks with their eyes. We should take great care of the lighting

arrangements; we must provide glasses if the child is too long-sighted; we should be most careful to use large type deeply printed; and, in any case, the periods of reading should be brief. It is much better to employ some kind of print that makes the letters in very simple shapes.

WHAT YOUR EYES SEE WHEN YOU ARE READING THIS PAGE

When we come to think of the case of a printed page, we shall see that the letters which we distinguish are the only places where the eye does not see. What we see when we read is not the black, but the white; the letters are not really anything that we see, but gaps in our seeing. As the white occupies a great deal more space than the black, it is evident that our eyes would be much less fatigued if the state of things were reversed, and books were printed in white letters on black paper. If that were so, the eye would be rested everywhere except where there were the letters which it wishes to see.

But reading is not the only use for the eyes, and there are a great many people who think that, while we spend so much time upon reading, we are forgetting to keep our eyes open in other ways.

The time may come when the education of the eye in other matters than reading will always be included in the upbringing of any child. The time for this education, as for every kind of education, is youth, and one great difference between this kind of education of the eye and the kind that has to do with reading and writing is that it is much more suited to the young eye, which it cannot harm.

HOW GAMES OF BALL TEACH THE EYES TO WORK TOGETHER

First, then, we should educate the eye as an instrument to work with the rest of our bodies. This is the great value of games of ball for young people. They teach the two eyes how to work together, how to judge distance and rates of movement, and then, by practice, they make strong and sure connections between the parts of the brain that have to do with the eye and those which give orders to the muscles. In the whole of the after life it is exceedingly valuable to have these different brain centres well connected in this way.

Second, the eye should be carefully trained by means of drawing and modelling. We are all clumsy when we are very young. The good use of the fingers is invaluable in a thousand ways. One of the great reforms in education of the near future will be the greater use of the hands and fingers.

This really means the greater training of the eye, for a good deal of clumsiness of the finger is really clumsiness of the untrained eye. Drawing and modelling strain the eyes far less than reading and writing, and a great argument in their favour is the pleasure with which children take to them. They not only train the eye as an instrument of the will, helping us to do what we want, but they also train it as an instrument of the part of our nature which thinks.

A GREAT MAN WHO WOULD STAND FOR TEN MINUTES BEFORE A FLOWER

The highest use of the eyes is that which is most neglected in all systems of education at present; it is the use of the eyes as instruments for observing with, for seeing what are the facts of earth and sea and sky, so that we may think about them—that is to say, the highest use of the eye is that which serves the highest part of our minds, but for this the eye requires great training.

A little story about one of the greatest men who ever lived will show us the difference between the eye that has been taught to see and the eye that has not been so taught.

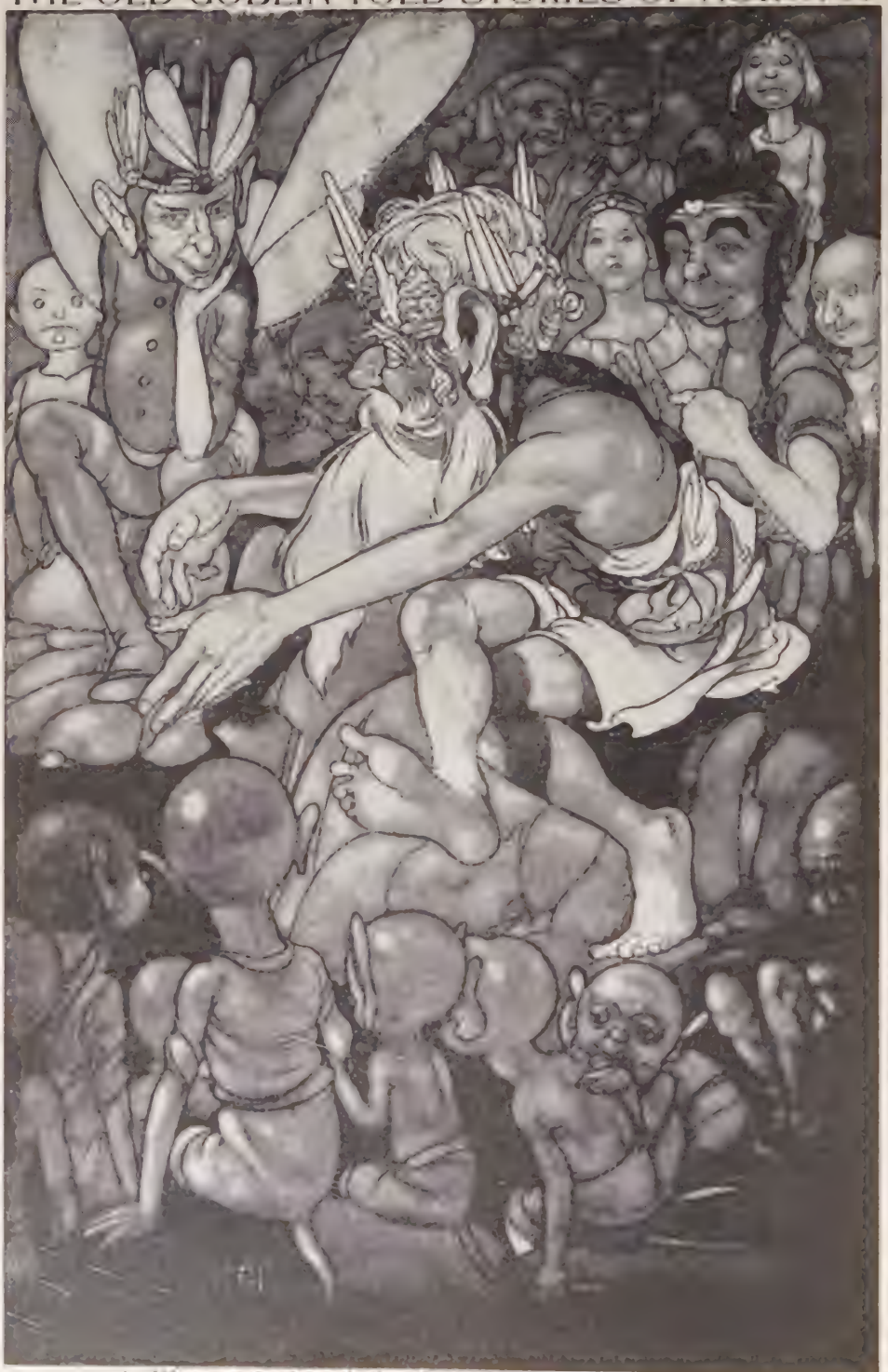
One of his friends once asked Charles Darwin's gardener about his master's health, and how he had been progressing lately.

"Oh," he said, "my poor master has been very sadly! I often wish he had something to do. He moons about in the garden, and I have seen him stand doing nothing before a flowe for ten minutes at a time. If he only had something to do, I really believe he would be better."

But Darwin was really seeing great truths about the flower which no eye had ever seen before, and which the gardener was quite incapable of seeing, however closely he might look at the same flower. It is the kind of seeing which was practised by Charles Darwin that we should also try to practise.

The next part of this is on page 4627.

THE OLD GOBLIN TOLD STORIES OF NORWAY



The old goblin from Norway spoke gloomily about the stately pines and leaning mountains of his home. He told of the clear winter nights, the sledge-bells, and how the boys run with torches over the smooth ice.

THE ELFIN HILL

CONTINUED FROM 4380

SOME lizards were scampering about in the hollow of an old decayed tree.

"What a noise is going on in the Elfin Hill!" said one. "I have not been able to close my eyes for two nights."

"They propped up the top of the hill with four red posts till cock-crow this morning, so that it is well aired, and the elfin maidens have learned new dances," said another lizard.

"The blind earth-worm has just come from the Elfin Hill," cried a third lizard. "He says that they expect grand company. All the will-o'-the-wisps are preparing a torch dance."

"Who can these strangers be?" asked all the lizards. "Whatever is the matter?"

Just then the Elfin Hill opened, and an old elfin maiden came out and tripped down to the seashore to the night-raven.

"You are invited to the hill to-night," said she; "but the king wishes you to take round the invitations."

"Who is to be asked?" asked the raven.

"Everyone may come to the great ball, even humans, if they can only talk in their sleep. But for the feast we can only ask persons of high rank, the merman and his daughter, all the old demons of the first class, with tails, the hobgoblins, and the little imps."

"Croak!" said the night-raven, as he flew off on his errand. The elfin maidens were already dancing, clad in shawls woven from moonshine and mist. The hall of the Elfin Hill had been washed with moonshine, and the walls glowed like tulips. In the kitchen frogs were being roasted, and salads of mushrooms and hemlock were being prepared. The king's gold crown was being polished with the best ground slate pencil, and there was a hustle and a bustle everywhere.

"Father dear," asked the elf-king's youngest daughter, "may I now hear who our noble visitors are?"

"I suppose I must tell you," replied he. "Two of my daughters must be married shortly, for the old goblin from Norway, who is very, very rich, is coming with his two sons, who are both seeking a wife. The old goblin is an honest old Norwegian, cheerful and straightforward, but they say that his boys are bad-mannered. You must show me that you know how to teach them manners."

Two will-o'-the-wisps then rushed in.

"They are coming! They are coming!" cried the foremost.

"Give me my crown," said the king, "and let me stand in the moonshine."

The daughters put on their shawls and bowed low. Before them stood the old goblin from Norway, wearing a crown of ice and polished fir-cones. Beside him were two strong, bare-throated men, his sons.

"Do you call that a hill?" said the younger, pointing to the Elfin Hill. "We should call it a hole in Norway."

"My boys," said their father, "a hole goes in and a hill stands out. Have you no eyes? Take care, or people will think that you are badly brought up."

They all entered the Elfin Hill, where the select company were assembled. The merman and other sea-folks sat in great water-tubs, and they declared that they were quite at home. All behaved perfectly except the two young men, who put their legs on the table.

"Feet off the tablecloth!" said their father. They obeyed but slowly, and then performed many other rude tricks.

But the old goblin was very different, and spoke pleasantly about the stately rocks and foaming waterfalls of his home. He told of the clear winter nights, the sledge-bells, and how the boys run with torches over the smooth ice. He described everything so vividly that all his hearers felt that they could see everything—the saw-mills going, the men singing, and the maidens dancing.

Then the elfin girls were asked to dance, and they danced with stamping feet, and ended by flying about like the shavings in a saw-pit, so that some of the company became giddy.

"Stop!" cried the old goblin. "Is that the only housekeeping they can do? Can they do nothing more than dance and make a whirlwind?"

"You shall soon see," replied the elf-king, and he summoned his youngest daughter. She put a white chip of wood in her mouth, and vanished immediately. The goblin said that he should not like a wife of his to be able to do this.

Another daughter made a figure follow her like a shadow, which no goblin ever has. The third had learnt in the brew-house of the moor witch how to make elf-puddings with glow-worms.

"A good housewife," said the old goblin, and smiled at her. Then came the fourth daughter carrying a large harp, and when she struck the first chord everyone lifted a leg, and at the second all had to do what she wished.

"She is a dangerous woman," said the old goblin; and his sons walked out, for they had had enough of it.

"And what can the next daughter do?" asked the old goblin.

"I have learnt all that is Norwegian," replied she; "and I will never marry unless I go to Norway."

But her youngest sister whispered:

"That is only because she has heard in a song that when the earth decays the cliffs of Norway will remain, and she wants to get there and be safe."

"Ho, ho!" laughed the old goblin, "is that what she means? What can the seventh and last do?"

"The sixth comes before her," said the elf-king; but the sixth daughter would not advance a step.

"I can only tell the truth," said she. "No one cares for me, nor troubles about me; and I have enough to do to look after myself."

So the seventh came forward, and she was able to tell stories, as many as one wished on any subject.

"Now, here are my five fingers," said the old goblin; "tell me a story for each of them."

She took him by the wrist and told him stories so that he laughed until he almost choked

"Hold fast on to what you have!" cried the old goblin. "This hand is yours; for I myself will marry you."

Then she said that the stories about the ring-finger and the little finger had not yet been told.

"We will hear those tales in the winter," said he, "and also about the fir-trees and the beech-trees, and ghost stories, for no one in Norway can do it so well. How merry we shall be! It is indeed very pleasant to live in old Norway. But where are my sons?"

They were chasing the will-o'-the-wisps, blowing out their torches.

They said they had no wish to marry, and lay down on the table to sleep. But the old goblin exchanged boots with his bride, as the custom was, and danced about with her until cock-crow.

The hill then closed up, and the lizards said one to another:

"How delightful was the old goblin!"

"His sons pleased me more," said the earth-worm; but, then, that poor, simple creature was quite blind.

THE STORY OF THE MONTHS

JANUARY; FEBRUARY; MARCH; APRIL; MAY; JUNE; JULY; AUGUST; SEPTEMBER; OCTOBER; NOVEMBER; DECEMBER

ALL the gods are dead. Centuries have rolled away since men believed in them. And yet the memory of these old gods and goddesses are enshrined in many forms, and will endure to the end of time. So deep was the faith of the Romans in their gods that throughout the world the names and characters of these mythical persons are associated with some of the most sacred and some of the most practical affairs of modern life. Some of the ghosts of the dead gods even haunt the months that make up the total of the Christian calendar. Let us imagine that we are witnessing a pageant of the months.

First would come a strange figure, a god with two faces, a god who looks forward and who looks back, and who carries in his left hand a key. This is Janus. The Romans worshipped Janus in a temple that was kept open during war, but was closed in times of peace. He was the god of Beginnings and Ends. The pious Roman who wanted to begin a matter well, or to make a good end of something, implored the assistance of Janus. This god was also the doorkeeper of heaven, and the Romans regarded him as the protector of their gates and doorways. His temple had twelve doors in it, just as the year has twelve months.

It was a clever idea of the Romans to name the first month of the year after Janus, because he suggests looking forward and looking back. Everyone who thinks at all feels at the beginning of a year that it is a time for looking back on the past, and also a time for looking forward to the future. It is a month of beginning and a month of end.

THE ROMANS NAMED THE FIRST MONTH JANUARY, AFTER THE TWO-FACED GOD JANUS

The second figure in our pageant is February, a month set apart. At one time February was the last month in the year, but 450 years before Christ it was placed after January instead of before, and became the second month. Later on, March was reckoned as the beginning of a year, and so February once again became the last month. Now it has settled down to its second place. But every four years February has one day

THE NAME OF FEBRUARY COMES FROM A ROMAN FESTIVAL WHICH WAS CALLED FEBRUA

added to its twenty-eight, and so it remains, the most restless and unsettled month in the calendar. This extra day is added because a full year consists of 365 days 6 hours, and at the end of four years these odd six hours have mounted up to a whole day of twenty-four hours; it is given to February to make up for its short allowance of twenty-eight days.

The name February comes from a Roman festival of purification named Februa, in honour of the god Lupercus. The figure that passes before us in the pageant suggests cleansing and purifying. In our own time it is towards the end of February that the housewife thinks about her spring cleaning. The Romans regarded Februa as a festival for spiritual cleansing, but they celebrated the occasion by over-eating. The third figure in our pageant clatters by in a chariot which is drawn by two horses, named Terror and Flight. It is a mighty and threatening figure, brandishing a long spear, lifting a gleaming shield to heaven, and raising its head on high, so that the lightnings play about the great helmet. This is Mars, the god of war.

To the Romans, Mars was more than a mere fighter; they regarded him as a god who could do almost anything, because he was so strong. They prayed to him for rain, and consulted him in their private affairs, offering on his altar a horse, sheep, wolf, magpie, or vulture. When soldiers went to war, they carried with them a cage of chickens sacred to Mars, and before battle they would offer

MARCH, THE NOISY, BLUSTERING MONTH, WAS NAMED AFTER MARS, THE ROMAN GOD OF WAR

THE FOURTH MONTH, WHICH OPENS THE GATES OF SPRING, WAS CALLED APRIL, "THE OPENER"

corn to these sacred birds, eagerly watching to see if the food were greedily eaten or rejected; if the former, it meant that Mars was on their side, if the latter, that the day would go ill with them. Mars was associated in their minds with thunder and lightning, and yet the Romans believed that the woodpecker tapping the trunk of a tree was the answer of this blustering, noisy god to their prayers. March is very often a noisy, blustering month.

How different is the fourth figure in our pageant! It is not a god and not a goddess. It is the Angel of Spring. Gracious, exquisite, tender, and kind, April follows behind the dust of Mars' bloodstained chariot, sprinkling the earth with soft showers, and calling up in the ruts and gashes made by the fiery wheels flowers so slight, and pretty, and delicate that one almost weeps to see them. April is "The Opener." The Romans saw that this month opened the gates of birth and restored to life all those lovely and gentle things which had hidden in terror from the blasts of winter. "Omnia aperit!" they exclaimed in admiration; which means, "It opens all things." And so this month of beauty and new birth, when the earth wakes from its winter sleep,

MAY IS CALLED AFTER THE GODDESS MAIA, THE DAUGHTER OF ATLAS, WHO UPHELD THE WORLD

JUNO, WHO RODE IN A CHARIOT DRAWN BY PEACOCKS, GAVE HER NAME TO JUNE

when the buds appear on the branches, and the woods are filled with song, is called April—"The Opener."

Behind April comes the goddess Maia. Her father was named Atlas, and it was supposed that the weight of this vast round world on which we live, with all its mountains and oceans and deep mines, rested upon the shoulders of Atlas. He had seven daughters, who lived in a mountain, and Maia was the most famous of all these seven daughters because of her son, Mercury, who ran swiftly from heaven to earth on errands for the gods and goddesses. Jupiter, the father of all the gods, took Maia and her sisters and placed them near together as stars in the sky. The cluster of six stars called the Pleiades are supposed to be Maia and her sisters. The seventh star of the cluster is invisible. It represents one of the sisters who married a man named Sisyphus, and ever after, because poor Sisyphus has been condemned to roll a stone up a hill eternally, she has hidden her face with sorrow.

Two figures come next, disputing the sixth place in the pageant. One is the goddess Juno, and the other is a man, Junius. Some people think the month belongs to Juno, and others to the great Roman family of Junius.

We will let the two figures fight it out. Neither of them interests us very much. Juno was the beautiful but jealous wife

JULY WAS AT ONE TIME CALLED QUINTILIS, BUT WAS RENAMED IN HONOUR OF JULIUS CÆSAR

AUGUST WAS NAMED AFTER AUGUSTUS, THE FIRST OF THE ROMAN EMPERORS

of Jupiter, who drove about in a chariot drawn by strutting peacocks, and Junius was a proud and haughty man, without modesty, humility, or sweetness. These two contend for the brightest and grandest place in the calendar, the month of roses and garden glory. Whichever wins in this contention, we shall call June the month of God. We feel no admiration for the goddess or for the man; our hearts are rejoiced by the splendour of summer, and we give the glory of June to the Giver of all beauty and all joy—the mighty God who is also our Father.

The seventh figure in the pageant is one of the greatest men who ever lived, a soldier and an emperor, Julius Cæsar. When the year began with March, this month was the fifth, and the Romans called it Quintilis, which means the fifth month. Julius Cæsar not only conquered nation after nation, and not only made wise laws and wrote immortal books, he also set himself to reform the calendar. He himself made the fifth month the seventh, and because the old name of Quintilis would not suit, and because he himself was born in this month, he said that the seventh month in the year should be named July.

It would take far too long to tell the story of Julius Cæsar, but we must remind ourselves, before he passes on, that he it was who invaded Britain and first taught the barbarians of that island to respect law and to desire civilisation.

After Julius Cæsar follows his grandnephew Augustus. At first he was called Octavius, and ruled the Roman Empire with Mark Antony and Lepidus. Finally he became sole emperor, and did much that added to the glory and power

THE NAME OF SEPTEMBER MEANS SEVEN, AND IT WAS AT ONE TIME THE SEVENTH MONTH

OCTOBER IS THE TENTH MONTH, BUT AT ONE TIME IT WAS THE EIGHTH, AS ITS NAME MEANS

of his magnificent empire. The people, anxious to flatter him, changed his name to Augustus, meaning noble. Then they called the eighth month August.

But July had thirty-one days, and August only thirty. The Romans thought that Augustus would be jealous of Cæsar's extra day, and so they took a day from February and tacked it on to the end of August. It is easy to remember that July and August have each thirty-one days by thinking of the two great Roman emperors. The eighth month was chosen for the reason that Augustus celebrated the chief events of his life during that time. It was in August that he was made consul, ended his wars, and conquered Egypt. Augustus remains for us a splendid figure in history. His reign was called the Golden Age, for not only did he bring peace to the war-tired world, but, under his patronage, literature and art flourished exceedingly.

The immortal poets, Horace and Virgil, lived at this time, libraries were built, agriculture developed, and temples and buildings rose up on every side in all the magnificence of marble. And it was in the reign of this mighty emperor that far away in Syria the Holy Child was born, whose reign has not yet ended, and whose birth has divided time. Little did the proud Roman emperor imagine, as he boasted in his palace of how he had found Rome made of brick and had left it of marble, that a Child was then living who would divide all the ages of

NOVEMBER, THE MONTH OF GUY FAWKES, WAS FORMERLY THE NINTH MONTH

the earth, and set a Cross between the reign of Augustus and the march of a new religion.

Behind the mighty Augustus in our pageant follows only a shamefaced figure VII. It is shamefaced because it knows that it has no right to be where it is.

September is the ninth month of the year, and to call it Septem, which means seven, is quite wrong. But our friend VII. raises a glance of appeal, and seems to say to us: "Do not turn me out. I at least serve one useful purpose; I remind you of the distant past when the year began with March, and when the month following August was in very truth the seventh of the year." But we cannot help smiling, for we think of people who date their letters like this—5/9/09, and wonder if they ever reflect upon the absurdity of making 9 stand for September, which simply means 7.

After VII. comes neither god, goddess, nor emperor, but another figure—VIII. Here again is the same shamefaced look and the same appeal to antiquity. Many things as false as the name October are allowed to pass in the world, on this same score of antiquity. People dislike altering things; they are too tired or too careless to touch the monuments of the past. The Romans, when they had given the name of their great emperor August to what was then the sixth month, felt that no one would be worthy to have a month named after him, and so let the old simple titles stand—September for the seventh, and October for the eighth month.

Even when the calendar was changed long years after the birth of Christ, and January became the first month, so great a hold had these old names laid upon the world that they were allowed to pass.

Again comes a figure—IX., meaning ninth month, or, as we say, November, although it is the eleventh. English children see this figure passing along disguised under a heavy cloak and a wide-spreading hat, with a barrel of gunpowder tucked under its arm, for November, to a great many English children, is the month of Guy Fawkes.

Our Saxon ancestors called it "Blood Month," because it was at this time they slaughtered many cattle to last them through the dreary months of winter.

Last of all comes another shamefaced figure—X. How strange that December, which is Latin for ten, should be the name for our twelfth month. But, of course, we know now that at one time this was not the last, but the tenth month in the calendar. December, which seems to us to mean the end, or the last, means simply the tenth. However, we don't bother our heads about the origin of the name when December comes; we can see coming towards us another and more cheerful figure. Big, happy, genial, and generous, comes Father Christmas, through the snow, riding over the hills, with his inexhaustible sack of toys. The gods and goddesses have departed, the Roman emperors have strutted out of sight, and the scene is filled by this jovial English figure, the good and affectionate Father Christmas, who ends up the pageant with a royal cheerfulness and a divine humanity.

DECEMBER, THE MONTH OF FATHER CHRISTMAS, IS THE TWELFTH, BUT ITS NAME MEANS TENTH

THE TIMID HARE

ADAPTED FROM THE JATAKAS

A HARE lived under a young palm-tree. One day, after his noon meal, he lay down under the tree. Suddenly he thought: "If the world should be destroyed, what would become of me?" At that very moment a large nut fell with a thud on a palm leaf. The loud noise in the tree above him startled the hare and he jumped up, exclaiming:

"This solid earth is breaking up! This solid earth is breaking up!" Without stopping to look around, he fled as fast as he could.

Another hare saw him scampering off, and said: "Why are you running so fast?"

"Pray don't ask me," said he.

"What is the matter?" asked the other, running after him.

Then the hare stopped a moment and, without even looking back, cried: "The earth here is breaking up." At this the second hare ran after the other. Other hares saw these two running and all joined in the chase until one hundred thousand hares were fleeing together as fast as they could.

The deer, the bear, and the buffalo saw them and asked the cause of their flight. On being told that the earth was breaking up, they, too, took to flight. The monkey, the tiger, and the elephant saw this bewildered herd dash by and they, too, joined the frightened host.

When the lion saw this multitude of fleeing animals, he roared:

"What is the matter? What has frightened you?"

"The earth is breaking up!" said they.

The lion said to himself: "I am sure the earth is not breaking up. Maybe some one heard a sound that made him think so. I must find out what it was. I must stop this headlong flight, or they will all perish."

So with great leaps and bounds, he dashed ahead of them and reached the foot of the mountain first. He roared three times. They were terribly frightened when they saw the lion, and, stopping suddenly in their flight, stood all huddled together. The lion walked calmly among them and asked why they were running away.

"The earth is breaking up!" they answered.

"Who saw it breaking up?" asked he.

"The elephants know all about it," was the reply.

He asked the elephants.

"We don't know," said they; "the tigers know."

"We don't know," said the tigers; "the monkeys know."

And so on until the hares were questioned.

"This one told us," said they, pointing to a particular hare.

"Is it true, sir," said the lion, "that the earth is breaking up?"

"Yes, sir, I saw it," was the answer.

"Where?" exclaimed the lion.

"In a grove of palms mixed with nut trees," said the hare.

"As I was lying under a palm sapling, at the foot of a nut tree, I thought, where shall I go if the earth should break up? At that very moment I heard the earth breaking up and I fled."

"Jump on my back," said he to the hare, "and we will return to the place of dreadful sound." Then he sprang forward and soon reached the palm grove.

"Now, friend hare," said he, "show me the place you meant."

"I dare not, my lord," was the answer.

"Come, don't be afraid," said the lion.

"Yonder, sir, at the foot of the nut tree," called the hare, standing afar off.

The lion went to the foot of the nut tree and there, in the exact spot where the hare had been lying, he found a ripe nut.

"The earth is not breaking up here," he exclaimed, "but that nut must have fallen with a thud on the palm leaf and scared the hare. Now I see the cause of all this disturbance."

With the hare on his back, he hastened back to the animals and told the whole story.

"Go back to your homes," said he; "the next time you hear of danger, be sure to find out exactly what it is before fleeing from it."

LORD MACAULAY'S UNFINISHED POEM

WE have already read on page 1403 one of the finest of Lord Macaulay's "Lays of Ancient Rome," and we can remember the splendid martial strain of his poetry. In the following fragment of what would have been a long and thrilling poem had he lived to complete it, he celebrates in the same spirited style an episode in the history of Great Britain quite as worthy to be remembered in poetry as any of the great events of ancient Rome. The phrase in the twenty-second line about "treading the gay Lilies down" refers to the lilies which are the royal emblem of France, and "semper eadem," in the thirtieth line, is the Latin for "ever the same."

THE SPANISH ARMADA

CONTINUED FROM 4400

ATTEND all ye who list to hear our noble England's praise;
I tell of the thrice famous deeds she wrought in ancient days,
When that great fleet invincible against her bore in vain
The richest spoils of Mexico, the stoutest hearts of Spain.

It was about the lovely close of a warm summer day,
There came a gallant merchant-ship full sail to Plymouth Bay;
Her crew hath seen Castile's black fleet beyond Aurigny's isle,
At earliest twilight, on the waves lie heaving many a mile;
At sunrise she escaped their van, by God's especial grace;
And the tall Pinta, till the noon, had held her close in chase.
Forthwith a guard at every gun was placed along the wall;
The beacon blazed upon the roof of Edgecumbe's lofty hall;
Many a light fishing-bark put out to pry along the coast;
And with loose rein and bloody spur rode inland many a post.
With his white hair unbonnet'd the stout old sheriff comes;
Behind him march the halberdiers, before him sound the drums.
His yeomen, round the market-cross, make clear an ample space,
For there behoves him to set up the standard of her Grace.
And haughtily the trumpets peal, and gaily dance the bells,
As slow upon the labouring wind the royal blazon swells.
Look how the Lion of the sea lifts up his ancient crown,
And underneath his deadly paw treads the gay Lilies down.
So stalk'd he when he turn'd to flight on that famed Picard field
Bohemia's plume, and Genoa's bow, and Cæsar's eagle shield:
So glared he when at Agincourt in wrath he turn'd to bay,
And crush'd and torn beneath his claws the princely hunters lay.

Ho! strike the flag-staff deep, Sir Knight; ho! scatter flowers, fair maids:
Ho! gunners, fire a loud salute: ho! gallants, draw your blades;
Thou sun, shine on her joyously—ye breezes waft her wide;
Our glorious SEMPER EADEM—the banner of our pride.
The freshening breeze of eve unfurl'd that banner's massy fold,
The parting gleam of sunshine kiss'd that haughty scroll of gold;
Night sank upon the dusky beach, and on the purple sea—
Such night in England ne'er had been, nor e'er again shall be.
From Eddystone to Berwick bounds, from Lynn to Milford Bay,
That time of slumber was as bright and busy as the day;
For swift to east and swift to west the ghastly war-flame spread;
High on Saint Michael's Mount it shone—it shone on Beachy Head.
Far on the deep the Spaniard saw, along each southern shire,
Cape beyond cape, in endless range, those twinkling points of fire;
The fisher left his skiff to rock on Tamar's glittering waves,
The rugged miners pour'd to war from Mendip's sunless caves.
O'er Longleat's towers, o'er Cranbourne's oaks, the fiery herald flew;
He roused the shepherds of Stonehenge, the rangers of Beaulieu.
Right sharp and quick the bells all night rang out from Bristol town,
And ere the day three hundred horse had met on Clifton Down;
The sentinel on Whitehall-gate look'd forth into the night,
And saw, o'erhanging Richmond Hill, the streak of blood-red light.
Then bugle's note and cannon's roar the death-like silence broke,
And with one start, and with one cry, the royal city woke.
At once on all her stately gates arose the answering fires;
At once the wild alarum clash'd from all her reeling spires;
From all the batteries of the Tower peal'd loud the voice of fear;

And all the thousand masts of Thames sent
back a louder cheer;
And from the furthest wards was heard the
rush of hurrying feet,
And the broad streams of pikes and flags
rush'd down each roaring street.
And broader still became the blaze, and louder
still the din,
As fast from every village round the horse
came spurring in;
And eastward straight, from wild Blackheath,
the warlike errand went,
And roused in many an ancient hall the
gallant squires of Kent.
Southward, from Surrey's pleasant hills flew
those bright couriers forth;
High on bleak Hampstead's swarthy moor
they started for the North.
And on, and on, without a pause, untired they
bounded still,
All night from tower to tower they sprang;
they sprang from hill to hill;
Till the proud Peak unfurl'd the flag o'er
Darwin's rocky dales,
Till like volcanoes flared to heaven the
stormy hills of Wales,
Till twelve fair counties saw the blaze on
Malvern's lonely height,
Till streamed in crimson on the wind the
Wrekin's crest of light,
Till broad and fierce the star came forth on
Ely's stately fane,
And tower and hamlet rose in arms o'er all
the boundless plain;
Till Belvoir's lordly terraces the sign to
Lincoln sent,
And Lincoln sped the message on o'er the
wide vale of Trent;
Till Skiddaw saw the fire that burn'd on
Gaunt's embattled pile,
And the red glare on Skiddaw roused the
burghers of Carlisle.

HUNTING SONG

The author of this very famous hunting song is unknown, but he was certainly a true poet and a lover of the chase, for his lively verses breathe the very spirit of England's time honoured sport. The song is evidently of the time of Henry VIII.

THE hunt is up, the hunt is up,
And it is well nigh day;
And Harry our king is gone hunting
To bring his deer to bay.

The east is bright with morning light,
And darkness it is fled;
And the merry horn wakes up the morn
To leave his idle bed.

Behold the skies with golden dyes
Are glowing all around;
The grass is green, and so are the treen
All laughing at the sound.

The horses snort to be at sport,
The dogs are running free,
The woods rejoice at the merry noise
Of hey tantara tee ree!

The sun is glad to see us clad
All in our lusty green,
And smiles in the sky as he riseth high
To see and to be seen.

Awake all men, I say again,
Be merry as you may;
For Harry our king is gone hunting,
To bring his deer to bay.

TO A MOUNTAIN DAISY

This beautiful poem, by the great Scottish poet Robert Burns, contains a few words of his native tongue which American boys and girls may not understand. These are maun (must), stour (dust), wa's (walls), bield (shelter), and histie stibble (dry stubble). Few of the other words vary much from ordinary English.

WEE, modest, crimson-tippéd flower,
Thou's met me in an evil hour;
For I maun crush amang the stour
Thy slender stem;
To spare thee now is past my power,
Thou bonnie gem.

Alas! it's no thy neebor sweet,
The bonnie lark, companion meet,
Bending thee 'mang the dewy weet
Wi' spreckled breast,
When upward springing, blythe, to greet
The purpling east.

Cauld blew the bitter-biting north
Upon thy early humble birth;
Yet cheerfully thou glinted forth
Amid the storm;
Scarce rear'd above the parent earth
Thy tender form.

The flaunting flowers our gardens yield
High sheltering woods and wa's maun
shield,
But thou beneath the random bield
O' clod or stane
Adorns the histie stibble field,
Unseen, alane.

There, in thy scanty mantle clad,
Thy snawy bosom sunward spread,
Thou lifts thy unassuming head
In humble guise;
But now the share uptears thy bed,
And low thou lies!

AT SEA

There is a fine sense of the swift movement of a great ship across the salt sea in this poem by Allan Cunningham, a Scottish author who lived from 1784 to 1842, spending the halt of his life in London, where he wrote a great deal about art.

A WET sheet and a flowing sea,
A wind that follows fast,
And fills the white and rustling sail
And bends the gallant mast;
And bends the gallant mast, my boys,
While like the eagle free,
Away the good ship flies, and leaves
Old England on the lee.

O, for a soft and gentle wind!
I heard a fair one cry;
But give to me the snorting breeze
And white waves heaving high;
And white waves heaving high, my boys
The good ship tight and free—
The world of waters is our home,
And merry men are we.

There's tempest in yon hornéd moon,
And lightning in yon cloud;
But hark the music, mariners!
The wind is piping loud;
The wind is piping loud, my boys
The lightning flashes free—
While the hollow oak our palace is,
Our heritage the sea.

HIS MOTHER'S JOY

LITTLE, I ween, did Mary guess,
As on her arm her baby lay,
What tides of joy would swell and beat,
Through ages long, on Christmas day.

And what if she had known it all,—
The awful splendour of his fame?
The inmost heart of all her joy
Would methinks have been the same:

The joy that every mother knows
Who feels her babe against her breast:
The voyage long is overpast,
And now is calm and peace and rest.

"Art thou the Christ?" The wonder came
As easy as her infant's breath:
But answer none. Enough for her,
That life had triumphed over death.

—JOHN WHITE CHADWICK.

THE LOST DOLL

I ONCE had a sweet little doll, dears,
The prettiest doll in the world;
Her cheeks were so red and so white, dears,
And her hair was so charmingly curled.

But I lost my poor little doll, dears,
As I played on the heath one day;
And I cried for more than a week, dears,
But I never could find where she lay.

I found my poor little doll, dears,
As I played on the heath one day;
Folks say she is terribly changed, dears,
For her paint is all washed away,

And her arms trodden off by the cows, dears,
And her hair is not the least bit curled;
Yet for old sake's sake, she is still, dears,
The prettiest doll in the world.

—CHARLES KINGSLEY.

THE MEN OF OLD

Lord Houghton, who was born in 1809 and died in 1885, was famous as the friend and patron of the poets of his days, eminent as a statesman, a great traveller, and no mean author both in prose and verse. In the following poem he justly celebrates the men of the past, whose lives were simpler than ours can be in this complex age. It is true that "a man's best things are nearest him." In all ages man has been prone to seek the things remotest from him, but it may be that this is Nature's way to maintain the progress of the race, although it is not the way to individual happiness.

I KNOW not that the men of old
Were better than men now;
Of heart more kind, of hand more bold,
Of more ingenuous brow;
I heed not those who pine for force
A ghost of time to raise,
As if they thus could check the course
Of these appointed days.

Still, it is true, and over-true,
That I delight to close
This book of life self-wise and new,
And let my thoughts repose
On all that humble happiness
The world has since foregone—
The daylight of contentedness
That on those faces shone!

With rights, though not too closely scann'd,
Enjoy'd as far as known,
With will, by no reverse unmann'd,
With pulse of even tone,
They from to-day, and from to-night,
Expected nothing more
Than yesterday and yesternight
Had proffer'd them before.

To them was life a simple art
Of duties to be done;
A game where each man took his part,
A race where all must run;
A battle whose great scheme and scope
They little cared to know,
Content, as men-at-arms, to cope
Each with his fronting foe.

Man now his virtue's diadem
Puts on, and proudly wears—
Great thoughts, great feelings, came to them
Like instincts unawares;
Blending their souls' sublimest needs
With tasks of every day,
They went about their gravest deeds
As noble boys at play.

And what if Nature's fearful wound
They did not probe and bare,
For that their spirits never swoon'd
To watch the misery there—
For that their love but flow'd more fast,
Their charities more free,
Not conscious what mere drops they cast
Into the evil sea.

A man's best things are nearest him,
Lie close about his feet;
It is the distant and the dim
That we are sick to greet;
For flowers that grow our hands beneath
We struggle and aspire—
Our hearts must die, except they breathe
The air of fresh desire.

Yet, brothers, who up Reason's hill
Advance with hopeful cheer—
Oh, loiter not, those heights are chill,
As chill as they are clear;
And still restrain your haughty gaze
The loftier that ye go,
Remembering distance leaves a haze
On all that lies below.

A NATION'S STRENGTH

These lines by Ralph Waldo Emerson, our great American writer, express the pith of much philosophy; and the strange thing is that while all will admit the truth which the poet utters, they are few, indeed, who can bring themselves to shape their own conduct in accordance with it.

NOT gold, but only man can make
A people great and strong—
Men who, for truth and honour's sake,
Stand fast and suffer long.

Brave men who work while others sleep,
Who dare while others fly—
They build a nation's pillars deep,
And lift them to the sky.

THE STORMY PETREL

The sea-bird of this poem ranges the ocean, hardly ever coming to land. It is a small bird, not much bigger than a lark, and, save for a few white feathers on wings and tail, sooty black in colour. Sailors call it "Mother Carey's Chicken," and, partly because it is always busiest in stormy weather, skipping from wave to wave, and partly because of its colour, look upon it as a bird of ill omen. The poem is by Barry Cornwall (Bryan Waller Procter), several of whose poems have already appeared in our book.

A THOUSAND miles from land are we,
Tossing about on the roaring sea;
From billow to bounding billow cast,
Like fleecy snow on the stormy blast.
The sails are scattered abroad like weeds;
The strong masts shake like quivering reeds;
The mighty cables and iron chains,
The hull, which all earthly strength disdains—
They strain and they crack; and hearts like stone
Their natural hard, proud strength disown.

Up and down! Up and down!
From the base of the wave to the billow's crown,
And amidst the flashing and feathery foam
The Stormy Petrel finds a home—
A home, if such a place may be
For her who lives on the wide, wide sea,
On the craggy ice, in the frozen air,
And only seeketh her rocky lair
To warm her young, and to teach them spring
At once o'er the waves on their stormy wing.

O'er the deep! O'er the deep!
Where the whale, and the shark, and the swordfish sleep,
Outflying the blast and the driving rain,
The Petrel telleth her tale—in vain;
For the mariner curseth the warning bird
Which bringeth him news of the storm unheard!
Ah! thus does the prophet of good or ill
Meet hate from the creatures he serveth still;
Yet he ne'er falters—so, Petrel, spring
Once more o'er the waves on thy stormy wing!

SORROW

We have our troubles, be they great or small, and it oftenest happens that that which hurts the deepest we shrink from uncovering to any human eye. This little poem by Alice G. Howard tells us that there is One from whom we may always be sure of obtaining sweetest sympathy and understanding.

THE sorrow that nobody mentions,
The sorrow no one may share,
Is the sorrow the dear Lord giveth
His sweetest, tenderest care.

He places His hand on the wellspring,
The quivering lips refrain,
And the eyes smile forth in defiance,
His love enfolding the pain.

He knows where the hurt is the deepest,
The tears of night and of day,
And, whispering softly, "I love you,"
Brushes the teardrops away.

The sorrow that nobody mentions,
The sorrow no one may share,
Is the sorrow the dear Lord giveth
His sweetest, tenderest care.

GREAT NATURE IS AN ARMY GAY

Richard Watson Gilder, who was born in 1844 and became editor of "The Century Magazine" in 1881, is an accomplished American poet. When he sings of nature, he sometimes strikes a serious and almost a forbidding note, as in this fine example of his skill. The brisk idea of the opening lines is not maintained, and the reader soon begins to think that nature's army, so far from being "gay," is an appalling host of ants or locusts that mean to devour everything in their path, leaving not a shred behind—not even the poor author.

GREAT Nature is an army gay,
Resistless marching on its way;
I hear the bugles clear and sweet,
I hear the tread of million feet.
Across the plain I see it pour;
It tramples down the waving grass;
Within the echoing mountain-pass
I hear a thousand cannon roar.

It swarms within my garden gate;
My deepest well it drinketh dry.
It doth not rest; it doth not wait;
By night and day it sweepeth by.
Ceaseless it marches by my door;
It heeds me not, though I implore.
I know not whence it comes, nor where
It goes. For me it doth not care
Whether I starve, or eat, or sleep,
Or live, or die, or sing, or weep.
And now the banners all are bright,
Now torn and blackened by the fight.
Sometimes its laughter shakes the sky,
Sometimes the groans of those who die.
Still through the night and through the livelong day
The infinite army marches on its remorseless way.

NOVEMBER IN ENGLAND

This poem is an excellent example of the half-serious, half-jocular spirit in which Thomas Hood could write when the mood seized him. He was, of course, capable of serious and more enduring work, as in his "Song of the Shirt," on page 2808, and "The Dream of Eugene Aram," on page 2123; but this little ode to November is perfect in its feeling of helpless despair. The description suggests London rather than England, and it was most likely out of the fulness of his own experience of a November fog in the metropolis that the afflicted poet produced this bundle of negatives.

NO sun, no moon,
No morn, no noon,
No dawn, no dusk, no proper time of day;
No sky, no earthly view,
No distance looking blue,
No road, no street, no "t'other side the way";
No end to any "row,"
No indications where the crescents go;
No top to any steeple,
No recognition of familiar people,
No courtesies for showing 'em,
No knowing 'em!
No travelling at all, no locomotion,
No inkling of the way—no notion,
"No go"—by land or ocean—
No mail, no post,
No news from any foreign coast;
No park, no ring, no afternoon gentility,
No company, no nobility;
No warmth, no cheerfulness, no healthful ease,
No comfortable feel in any member,
No shade, no shine, no butterflies, no bees,
No fruits, no flowers, no leaves, no birds—
November!

BATTLE-HYMN OF THE REPUBLIC

Mrs. Julia Ward Howe, who, in her ninety-second year, died in 1910, may be described as one of the most eminent women of America. She won fame both as a writer and a speaker, and wrote many books, but will be remembered chiefly for this celebrated poem, written in the early days of the American Civil War, to encourage the soldiers of the North in fighting for the preservation of the Union.

MINE eyes have seen the glory of the coming of the Lord :
He is trampling out the vintage where the grapes of wrath are stored ;
He hath loosed the fateful lightning of His terrible swift sword :
His truth is marching on.

I have seen Him in the watch-fires of a hundred circling camps ;
They have builded Him an altar in the evening dews and damps ;
I can read His righteous sentence by the dim and flaring lamps :
His day is marching on.

I have read a fiery gospel writ in burnish'd rows of steel :
" As ye deal with my contemners, so with you My grace shall deal ;
Let the Hero, born of woman, crush the serpent with His heel,
Since God is marching on."

He hath sounded forth the trumpet that shall never call retreat ;
He is sifting out the hearts of men before His judgment-seat :
Oh, be swift, my soul, to answer Him ! Be jubilant, my feet !
Our God is marching on.

In the beauty of the lilies Christ was born across the sea,
With a glory in His bosom that transfigures you and me :
As He died to make men holy, let us die to make men free,
While God is marching on.

SONG OF BIRDS

Longfellow in these pleasant verses seeks to impress our minds not merely with the remembered joy of the singing of some lark or throstle, but with a sense of the immenseness of the joyous bird-song which this world of ours contains. For though around our own house, or in the woods near by, the voices of the birds may be silent for the moment, elsewhere their songs are rising, as they will again rise on our own ears ; " the birds are singing for evermore."

DID you ne'er think what wondrous beings these ?
Did you ne'er think who made them, and who taught
The dialect they speak, where melodies
Alone are the interpreters of thought ?
Whose household words are songs in many keys,
Sweeter than instrument of man e'er caught ;
Whose habitations in the tree-tops even
Are half-way houses on the road to heaven !

Think, every morning, when the sun peeps through
The dim, leaf-latticed windows of the grove,
How jubilant the happy birds renew
Their old melodious madrigals of love !
And, when you think of this, remember, too,
'Tis always morning somewhere, and above
The awakening continents, from shore to shore,
Somewhere the birds are singing evermore !

THE PRINCESS

(*Selected*)

THE woman's cause is man's : they rise or sink
Together, dwarfed or godlike, bond or free :
For she that out of Lethe scales with man
The shining steps of Nature, shares with man
His nights, his days, moves with him to one goal,
Stays all this fair young planet in her hands —
If she be small, slight-natured, miserable,
How shall men grow ? but work no more alone !
Our place is much : as far as in us lies
We two will serve them both in aiding her —
Will clear away the parasitic forms
That seem to keep her up but drag her down —
Will leave her space to bourgeon out of all
Within her — let her make herself her own
To give or keep, to live and learn and be
All that not harms distinctive womanhood.
For woman is not undevelopt man,
But diverse : could we make her as the man,
Sweet Love were slain : his dearest bond is this,
Not like to like, but like in difference.
Yet in the long years liker must they grow ;
The man be more of woman, she of man ;
He gain in sweetness and in moral height,
Nor lose the wrestling thews that throw the world ;
She mental breadth, nor fail in childward care,
Nor lose the childlike in the larger mind ;
Till at last she set herself to man,
Like perfect music unto noble words.

— ALFRED, LORD TENNYSON.

THE UGLY PRINCESS

The moral of these verses by Charles Kingsley is that men foolishly judge by appearances, and are more apt to admire and bow before mere physical beauty than to look in one who is outwardly ugly for that inner and unfading beauty of the soul, though it often happens that a beautiful spirit has but a poor and unattractive dwelling-place.

MY parents bow, and lead me forth,
For all the crowd to see—
Ah, well ! the people might not care
To cheer a dwarf like me.

They little know how I could love,
How I could plan and toil,
To swell those drudges' scanty gains,
Their mites of rye and oil.

They little know what dreams have been
My playmates, night and day ;
Of equal kindness, helpful care,
A mother's perfect sway.

Now earth to earth in convent's walls,
To earth in churchyard sod :
I was not good enough for man,
And so am given to God.

LITTLE VERSES FOR VERY LITTLE PEOPLE

THE Hart he loves the high wood,
The Hare she loves the hill,
The Knight he loves his bright sword,
The Lady loves her will.

PLEASE to remember
The fifth of November,
Gunpowder, treason, and plot;
I know no reason
Why gunpowder and treason
Should ever be forgot.

HERE we go round a ginger ring,
A ginger ring, a ginger ring;
Here we go round a ginger ring,
Around about merry my Tansy.

A bowlful of nuts we sat down to crack,
Sat down to crack, sat down to crack;
A bowlful of nuts we sat down to crack,
Around about merry my Tansy.

What will you give us to tell his name,
To tell his name, to tell his name;
What will you give us to tell his name,
Around about merry my Tansy?

The last time is the catching time,
The catching time, the catching time;
The last time is the catching time,
Around about merry my Tansy.

"OLD woman, old woman, shall we go shearing?"
"Speak a little louder, sir, I am very hard of hearing."
"Old woman, old woman, shall I love you dearly?"
"Thank you, kind sir, I hear you very clearly."

MR. EAST gave a feast;
Mr. North laid the cloth;
Mr. West did his best;
Mr. South burnt his mouth
With eating a cold potato.

POOR old Robinson Crusoe!
Poor old Robinson Crusoe!
They made him a coat
Of an old nanny goat,
I wonder how they could do so!
With a ring a ting tang,
And a ring a ting tang,
Poor old Robinson Crusoe!

BETTY PRINGLE had a little pig,
Not very little, and not very big.
When he was alive he lived in clover,
But now he's dead, and that's all over.
So Billy Pringle he lay down and cried,
And Betty Pringle she lay down and died;
So there was an end of one, two, and three:
Billy Pringle he,
Betty Pringle she,
And the piggy-wiggy.

"MOTHER, may I go and bathe?"
"Yes, my darling daughter,
Hang your clothes on yonder tree,
But don't go near the water."

OH where and oh where is my little wee dog?
Oh where and oh where is he?
With his ears cut short and his tail cut long,
Oh where and oh where can he be?

THE POOR BABES IN THE WOOD

My dear, do you know,
How a long time ago,
Two poor little children,
Whose names I don't know,
Were stolen away on a fine summer's day,
And left in a wood, as I've heard people say?

And when it was night,
So sad was their plight,
The sun it went down,
And the moon gave no light.
They sobbed and they sighed, and they bitterly cried,
And the poor little things, they lay down and died.

And when they were dead,
The robins so red
Brought strawberry-leaves,
And over them spread.
And all the day long
They sung them this song:
"Poor babes in the wood! Poor babes in the wood!
And don't you remember the babes in the wood?"

NURSERY RHYMES OF THE CHILDREN OF FRANCE

The English version of these Rhymes appears side by side with the French.

C'est la mère Michel qui a perdu son chat.
Qui crie par la fenêtre à qui le lui rendra,
Et le compère Lustucru qui lui a répondu :
" Allez, la mère Michel, votre chat n'est pas perdu."
C'est la mère Michel qui lui a demandé :
" Mon chat n'est pas perdu ! vous l'avez donc trouvé ? "
Et le compère Lustucru qui lui a répondu :
" Donnez une récompense, il vous sera rendu."
Et la mère Michel lui dit : " C'est décidé,
Si vous rendez mon chat, vous aurez un baiser."
Le compère Lustucru, qui n'en a pas voulu,
Lui dit : " Pour un lapin votre chat est vendu ! "

Mother Mitchell one day lost her pussy, alack !
And cried out of window : " Oh, who'll bring her back ? "
Then old Gaffer Lustucru smilingly said :
" Your cat isn't lost—she is merely mislaid."
Mother Mitchell cried, hopefully gazing around her :
" My pussy not lost ! Oh, pray, have you found her ? "
Then old Gaffer Lustucru answered her pat :
" If you give a reward, you will soon get your cat."
Said old Mother Mitchell : " 'Twould not be amiss,
If you find me my pussy, to give you a kiss."
But sly Gaffer Lustucru much preferred gold,
And said : " As a rabbit your pussy is sold ! "

La boulangère a des écus
Qui ne lui coûtent guère ;
Elle en a, je les ai vus.
J'ai vu la boulangère aux écus,
J'ai vu la boulangère.

The baker's wife has sacks of gold,
And yet, upon my life,
She's not content, so I've been told.
I've seen the baker's wife's red gold,
And seen the baker's wife.

Fais dodo, Colas, mon petit frère,
Fais dodo, t'auras du lolo.
Maman est en haut,
Qui fait du gâteau ;
Papa est en bas,
Qui fait du chocolat ;
Fais dodo, Colas, mon petit frère,
Fais dodo, t'auras du lolo.

Hush-a-bye, Colin, brother of mine
Mustn't cry, hush-a-bye.
Mamma's up above,
Making cakes for you, love ;
And Daddy, downstairs,
Nice choc'late prepares.
Hush-a-bye, Colin, brother of mine,
Mustn't cry, hush-a-bye.

Au clair de la lune,
Mon ami Pierrot,
Prête-moi ta plume
Pour écrire un mot.
Ma chandelle est morte,
Je n'ai plus de feu ;
Ouvre-moi la porte
Pour l'amour de Dieu !
Au clair de la lune,
Pierrot répondit :
Je n'ai pas de plume,
Je suis dans mon lit.
Va chez la voisine.
Je crois qu'elle y est,
Car, dans sa cuisine,
On bat le briquet.

By the moon's silver ray,
Dear Pierrot mine,
A pen lend me, pray,
To write thee a line.
My candle has died,
With cold I'm aquake ;
Thy door open wide,
For dear Heaven's sake !
By the light of the moon,
Cruel Pierrot said :
I'll not grant thy boon,
For I am abed.
At our neighbour's, may be,
Thou canst letters indite,
In her kitchen, I see,
They are striking a light.

A BRAVE LITTLE QUAKERESS

IT was late afternoon of the 2nd of December, 1777. A light snow was sifting down upon the streets of Philadelphia, covering the pavements and houses with a frosting of white.

In one house on Second Street, a woman, her tranquil face framed in a Quaker cap, sat at the window. The knitting had dropped into her lap and her hands lay idle. She sighed once or twice as her eyes rested upon the red-coated sentinel who marched up and down in the gathering dusk before the house across the street. The British were in possession of the town and the house opposite had become the headquarters of General Howe. Presently she saw the door of the house open and an officer came out. The woman could hear the faint click of the musket as the sentinel saluted. The officer hurried across the street and before the woman realised it, he was knocking at her door. She hastened to let him in.

"Can I do anything for thee?" she inquired. Her placid, even voice did not betray the agitation that she felt. The officer was the adjutant-general of the British army.

"I should like to use your room upstairs for a private meeting of some of my officers to-night," said the officer. Then as he was departing he added emphatically, "And be sure, Friend Lydia, your family are all in bed at an early hour. When my guests are ready to leave the house, I shall myself awaken you that you may let us out and extinguish the fire."

Lydia at once set about putting all things in readiness before her husband should return home for dinner. As she hurried busily to and fro her mind was keeping pace with her hands and feet. An indefinable feeling of uneasiness took possession of her. The British officers had met several times before at her house but to-night she could not shake off the presentiment that something of great importance was to take place.

Immediately after dinner, Lydia hurried her family to bed as soon as she could. Presently she heard a loud knocking at the front door. With a candle in her hand she slipped downstairs and let in the British officers.

Then she went to her own room and threw herself without undressing upon the bed. She tried to sleep, but all her uneasy fears of the afternoon came thronging back through her mind. What could those British officers be planning? Surely no good for the army of her own dear land. She lay there, her eyes staring into the darkness, her fingers clasping and unclasping each other in a spasm of nervousness. Presently she could bear it no longer. She sat up on the bed and feverishly unfastened her shoes and slipped them from her feet. Noiselessly she stole out of her room down the hall. For a moment she paused uncertainly by the door behind which the British officers were closeted. She could hear the murmur of eager voices. Then she caught a word that sent the hot blood pulsing into her cheeks. All her hesitation was swept away. She leaned forward and pressed her ear to the keyhole. A voice was reading a paper aloud. It was an order for the British troops to make a secret night attack upon the American army encamped at White Marsh.

Lydia had heard enough. She fled down the hallway to her room and creeping into bed she tried to still the beating of her heart and to think. A few minutes later someone rapped loudly upon her door. Lydia

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paid no heed. It was as well for the officer to think that she was asleep. The knock came again, but still Lydia did not stir. Again it was repeated. This time with unmistakable loudness and impatience. Lydia rose quickly and opened the door. As she had expected, it was the adjutant-general, who had come to notify her that they were going. When the officers had left, Lydia returned to her room and to bed. But sleep was a stranger to her that night. Restlessly she tossed to and fro. She must save her fellow countrymen from the danger that threatened them, but how? How? If she told her husband and asked him to help her, that would place him in special peril as the sharer of her secret. No, no, — she would bear the risk alone.

"O Father in Heaven!" she prayed, "Guide thy servant in this, her hour of need." Presently her resolution was formed. She could not sleep, but now she could wait quietly for the coming of the day. She knew what she would do on the morrow.

She spoke to her husband at breakfast about the subject that was uppermost in her thoughts.

"John, if thee would not mind, I should like to go to Frankfort to-day to get some flour for our household."

"Certainly, Lydia," replied her husband tranquilly, "but thee must take the servant with thee to carry thy bag."

"Nay, I will go alone, for I cannot spare the maid from the house to-day. There is much work to do."

"Well, well, do as thee likes best," replied John indulgently as he departed on his business.

Lydia at once hurried over to the British headquarters to secure a written permission to pass through the British lines. Then with her bag under her arm, the demure little Quakeress set out through the snow to Frankfort, about five miles distant. There she left her bag at the mill, and slipping unnoticed from the town, she hurried in the direction of the outposts of the American army almost at a run. She knew that she carried her life in her hands for if the British learned of her errand, they would show her no mercy. Breathlessly, she pressed along the snow whitened road. Suddenly there came to her ear the steady beat of an approaching body of horsemen. The woman stopped, her hand pressed against her aching side, her heart choking into her throat. Suppose it were the British. Then she gave a little sob of relief. "Thank God!" she whispered, "Thank God!" The approaching horsemen wore the blue uniform of the American cavalry. It was a very quiet and composed little Quakeress before whom the cavalry officer dismounted and took off his hat.

"I would speak with thee, alone," she announced gravely.

"Very well, madam," he returned courteously. "Ride ahead, men. I will join you presently," he commanded. Then quietly and unhurriedly, Lydia disclosed her secret.

"I would ask thee not to betray to anyone whatsoever to whom thou owest the knowledge of this matter," she added when she had finished.

"I cannot thank you enough, madam, for the service you have done us," said the officer gratefully, "and you may rest assured that no one will ever learn from me the source of my information. Pray let me conduct you to a house nearby where you can rest and get something to eat before you return to town."

"No, I thank thee, friend," returned Lydia, "I must return with all haste or perchance someone may miss me and suspect my errand."

With a light heart, the brave little woman pursued her way homeward, carrying the bag of flour which had been the supposed reason for her visit to Frankfort. She had tried her best to save the American army, yet she was not wholly free from fear as to the results.

Two days later, a thunderous knocking on the front door of her home brought Lydia's heart into her mouth. She knew that the crisis had come. With a silent prayer on her lips she obeyed the summons.

A British officer stood before her. His face was dark and relentlessly

stern. He locked the door behind him and motioned Lydia to a seat.

"Were any of your family up, Lydia, on the night when I received company in this house?"

"No," answered Lydia, truthfully; "They all retired at eight o'clock."

"That is strange," growled the officer. He gnawed his moustache, frowned to himself, muttering, —"Very strange! Very strange! She was asleep, I know, for I knocked three times at her door before she heard me." Aloud, he went on to Lydia, his keen eyes searching her placid face for a sign of betrayal:

"I am altogether at a loss to conceive who could have given the information of our intended attack to General Washington. When we arrived near his encampment we found his cannon mounted, his troops under arms, prepared at every point to receive us. We had to march back like a d—— parcel of fools!"

"I sent the family to bed at eight o'clock," Lydia repeated in her even voice. "I do not believe any of them were up after that hour." The officer looked at the straight little figure standing before him for a minute, then he strode out of the house, clanging the door behind him.

When the resounding footsteps had died away, the small, gray figure slipped to its knees, face buried in hands. "Thank God," Lydia sobbed, "Thank God for a merciful deliverance!"

POCAHONTAS

A WHITE man squatted alone on the floor of an Indian wigwam. His bearded face rested in his hands and every now and then he scowled thoughtfully into the gathering gloom of the evening as he restlessly gnawed his moustache. The sound of guttural mutterings and of leaves scuffling under soft shod feet drifted in through the openings of the wigwam. The white man threw back his sturdy shoulders impatiently.

"If I am to be roasted and eaten, I might as well know it," he growled, "I am sick unto death of this delay."

Before the words were off his lips, the flap of the wigwam was pushed softly aside and an Indian warrior, hideously bedaubed with red and blue paint, slipped through the opening and stood before him.

"Let the White Father make ready to go to the emperor, the great Powhatan," the Indian announced impressively.

"I have been ready this long while," returned the prisoner shortly.

"The White Father must come with me." The Indian made a motion as if he would lay hold of the white man's arm. The prisoner stepped back.

"Keep your hands off me," he said harshly. "Lead on and I will follow," he added imperiously.

The Indian gave him a quick glance and the glance held hatred. He could not understand all the white man's words, but he had caught the tone of contempt and loathing. He turned on his heel abruptly and strode out of the wigwam.

The prisoner followed. For a moment a glare of light blinded his eyes. Then gradually he made out the scene into which he had been ushered. A great council fire blazed against the shadowy background of the forest. In the fitful light of the leaping flames, the prisoner could make out the forms of two hundred or more Indian warriors, all fantastically bedecked with paint and feathers like his guide. In the centre of the council a throne-like platform had been raised, and on the platform was seated Powhatan, the warrior chieftain, a robe of raccoon skins flung across his bronzed shoulders, his head decorated with the white feather head-dress of a chief.

The appearance of the prisoner was the signal for a blood curdling yell that came weirdly echoing back from the shadowy forests. He was conducted before the throne of Powhatan. In the solemn silence that had settled down upon the council, one Indian woman tendered him a bowl of water to wash his hands, while another

handed him a bunch of feathers with which to dry them.

After the ceremony of washing, an abundance of all kinds of food, cooked in the Indian fashion, was placed before the prisoner. Although naturally far from hungry, he forced himself to partake freely of the messes placed before him, while he coolly ran his eyes over the dusky throng gathered about, searching in vain for some friendly glance. Dark looks of hatred and distrust met him on every side. Suddenly his eyes met those of a little Indian maiden who was seated on the left of Chief Powhatan. He let his glance rest in hers for one brief moment only and then composedly went on in his inspection of the dusky, moving figures. But his heart beat faster. Could it be possible that he had read a message of sympathy in that quick, dark glance? Without seeming to do so he inspected the girl. She was little more than a child after all. The man guessed that she could not be more than twelve or fourteen years old. He reflected that Indian girls developed into womanhood very early.

At last the tiresome ceremony was over. There was a long consultation between Chief Powhatan and his warriors, which came to an end with a startling, ominous whoop. The prisoner's heart sank heavily as he tried to read his fate in the stolid, expressionless faces of the Indian braves. However, from the signs that passed between them, he knew that he was to suffer death. Two large stones were rolled before Powhatan. The prisoner watched the proceedings with stern calmness. He knew what was to follow.

Suddenly the Indians nearest to him laid hold of his arms and dragged him to the spot. With eager, savage fingers they forced him to his knees and pressed his head down upon the stone block. A warrior stepped forward with a huge club. They were going to beat out his brains. The savage waited with upraised arm for Powhatan's signal. The prisoner closed his eyes and snapped his teeth firmly on his lower lip. He would show these savages that a white man could die as stoically as any Indian brave. The awful, waiting hush was broken by a sudden, piercing shriek. The man with his head on the block opened his eyes — startled. A slim, dusky figure flashed from Powhatan's side. Two brown arms were thrown about the white man's neck. Then a shout of wonder broke from the savage multitude.

"Pocahontas!"

It was the idolised daughter of their mighty chief who had placed her head between the White Chief and the executioner's club.

"No! No! Slay him not! He shall not die!" The girl was crying in her mellow Indian tongue.

The Indian executioner, confused and abashed, let his uplifted club fall slowly to the ground. He dared not strike, or the blow would fall on the head of the darling of their tribe. Before he had time to gather his thoughts, Pocahontas arose and darting to her father's side, threw her arms about him. Brokenly, with the tears streaming down her cheeks, she pleaded for the white man's life, pleaded with the stern old chief who showed mercy to no man. The girl spoke with an eloquence and passion that moved the multitude of crowding savages. Suddenly exhausted, Pocahontas slipped to the ground and hid her face against the chieftain's knees, choking. A shout of sympathy rent the crowd. Powhatan raised his hand with a silencing gesture.

"Let the White Chief go," he said slowly.

Again a wild shout went up from the multitude, and this time it was a shout of delight. Pocahontas had completely won them to her cause. The white man's life was saved. A few days later the prisoner, whose name was Captain John Smith, returned to Jamestown and his own people, and in his heart he bore with him a lifelong gratitude to a little, dusky Indian maiden — Pocahontas.

LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Un jour quelque chose s'abbattit sur la fenêtre de la salle d'étude.
One day something itself fell upon the window of the room of study.
One day something flew in at the school-room window.

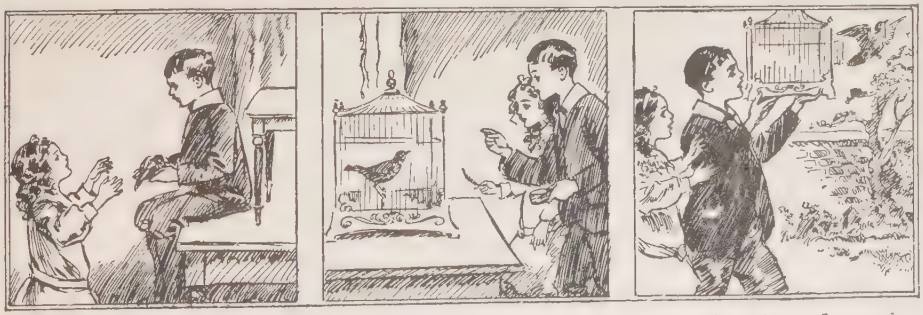
Les enfants sautèrent. "Regarde!" s'écria Ethel. "C'est une petite grive."
The children jumped. "Look!" herself cried Ethel. "This is a little thrush."
The children jumped up. "Look!" cried Ethel. "It is a little thrush."

"Essayons de l'attraper," dit Guillaume. L'oiseau était sur les rideaux.
"Let us try of her to catch," said William. The bird was upon the curtains.
"Let us try to catch it," said William The bird was on the curtains.

Il essaya de l'atteindre, mais il était trop petit. Il considéra un moment.
He tried of it to reach, but he was too little. He considered a moment.
He tried to reach it, but he was too short. He thought a moment.

Guillaume mit une chaise sur la table, monta dessus, et étendit la main.
William put a chair upon the table, mounted upon, and extended the hand.
He put a chair on the table, climbed up, and put out his hand.

L'oiseau ne bougea pas. "Pauvre petite grive!" dit-il. "L'aile est blessée."
The bird not stirred not. "Poor little thrush!" said he. "The wing is hurt."
The bird did not move. "Poor little thrush!" said he. "Its wing is hurt."



"Laisse-moi le voir," dit Ethel, courant à la table et étendant la main.
"Leave me him to see," said Ethel, running to the table and extending the hand.
"Let me see it," said Ethel, running up to the table and holding out her hand.

"Nous le mettrons dans une cage et le soignerons." "Quelle bonne idée!"
"We it will put into a cage and him will care for." "What good idea!"
"We will put it in a cage and take care of it." "What a good idea!"

Aussitôt que le petit oiseau était tout à fait bien, il désirait encore la liberté.
As soon as the little bird was all to made well, it desired again the liberty.
As soon as the little bird was quite well, he wanted to be set free again.

Les enfants ouvrirent la porte de la cage et l'heureuse grive s'envola.
The children opened the door of the cage and the happy thrush herself flew away.
The children opened the cage door and the happy thrush flew away.